COAL AGE

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RIGHT now is the time to sit down and ask yourself the following questions: Has the past year been a successful one with me? Have I accomplished all that was possible? Did I neglect my opportunities and make mistakes which might easily have been avoided?

The man who doesn't balance up his personal ledger of human action once in 12 months is both careless and unwise. The blunders of yesterday are the best teachers of today. We all know what we can do; the great achievement is to learn what we cannot do. Aid from others is mechanical; it is only when we make our own discoveries that the full effect remains.

The broader the range of our personal observation, the sounder will be our judgment. Carefully digested experience takes up no room, and may be carried about as our companion everywhere, without cost or encumbrance. Nature is frugal in her operations and refuses to give knowledge which experience will soon produce.

But few people fail through not knowing how to succeed. The principal weakness in human character is lack of determination. Most of us are inherently lazy, and we balk on paying the price of success in expended effort and personal discomfort. We have bright dreams of a vague uncertain tomorrow, while we waste a real today. When we deliver four hours' work for eight hours' pay, we cheat ourselves more than we do the boss.

It is almost certain that, when we as individuals review our work of the past year, it will be found that want of promptitude in action has been a serious hindrance in our way of progress. Promptness is the mother of confidence, and dispatch is better than discourse. Immediate vigorous action robs a dreaded task of half its terrors, while anticipation will clothe a disagreeable job with new and imaginary difficulties.

We frequently delay so long considering where to begin that the chance to act slips by. The golden opportunity we lose by loitering in the morning cannot always be retrieved in the evening. One reason why many of us remain so long in the school of adversity is because we spend so much time crying over our lessons, instead of learning them. Fretting is an evil force that fosters the faults it seeks in vain to correct.

The usual fortune of complaint is to call forth contempt more than pity. We forget that our view of a matter is influenced by the position we happen to occupy, and we are too apt to see the abuse of a thing and consider this abuse a valid argument against its proper use. No good can come from grumbling; if our ills are reparable, fault-finding is ungrateful; if remediless, it is vain.

The men who find the most fault are rarely those who work effectively to destroy the evils complained of. Never do we portray our own character more vividly than in our manner of portraying another's. If we despise happiness and light, let us at least not embitter the lives of others by puffing at the little flame that warms and cheers them.

Start the New Year fired by a determination which knows no defeat, which cares not for hunger or ridicule, which spurns hardships and laughs at want and disaster. Resolve to make a way, if no way is open, and don't forget that "tenacity of purpose" has a great moral bearing on our success—it leads others to have confidence in us, and confidence is everything.

Coal Mining Institute of America

By William Seddon*

This institute is the oldest organization in the United States devoted solely to the study of coal mining. It originated in 1887, was known as the Western Pennsylvania Mining Institute and met in Monongahela City. In 1890 the name was changed to the Central Mining Institute and its annual meeting was transferred to Pittsburg.

*Brownsville, Penn.

Note—An abstract of an article entitled "A Brief History of the Early Days of the Coal Mining Institute of America," read before that body Dec. 18, at a meeting held at Pittsburgh, Penn.

The first important mining law for the bituminous regions of Pennsylvania came into effect on June 30, 1885. This legislative instrument called for the examination of all who desired to act as mine foremen or firebosses. This came as a complete surprise to a number of men anxious for advancement yet not equipped with sufficient mining knowledge. It was at the close of the first firebosses' examination held in Monongahela which, at that time, was called Monongahela City, in the latter part of November, 1885, that the caucus was held, out of which the present Institute was formed.

The Founders of the Institute

At the close of the examination mentioned, several of the candidates, of whom I was one, with James Louttit, William West, William J. Mollinson and Malcolm Cochran, all of whom are now dead, James Black, John McVicker, Henry Kinlock, R. B. Drum, Joseph Blower and several others met to discuss the formation of an institute.

The firebosses' examination in the first bituminous district preceded, by only a few weeks, similar examinations in the various bituminous districts of Western Pennsylvania. Questions presented at these examinations were by no means of a simple character. Consequently throughout the mining region there was created a large desire for more adequate information.

The Institute Informed and Educated the Industry

At that time, the problems of mining had not been discussed as thoroughly as they have been in more recent years and the would-be mine foreman or fireboss was placed at a considerable disadvantage by reason of this fact. The only available journal or mining paper which treated on subjects in a manner which could be fairly understood by the rank and file of miners, was the *Colliery Engineer*, afterward named *Mines and Minerals*.

Only a small per cent. of the candidates for the examination in question were readers, at that time, of that interesting journal. Too often in those early days the principal qualification of a mine foreman was a knowledge of how to lay tracks, haul coal and water, dig ditch and perform other work not requiring much information or skill.

The Idea is Shelved for Two Years

Before adjourning the meeting to which reference has been made, a resolution was passed that the caucus reassemble in the near future at Monongahela for the purpose of formulating some plan whereby the members of that informal convention might establish an institute and arrange to instruct themselves further in the practice of mining. Many such resolutions have been made before without anything definite being accomplished, but during the following year many of those who desired to receive certificates failed to qualify themselves and the demand for increased knowledge was accordingly strengthened.

Consequently, through the columns of the journal of which I have just spoken, I proposed that a meeting of all who were interested in the matter should be held without delay. As a result of this letter and of the influence and assistance of the late Henry Louttit, a meeting was held at Monongahela, July 9, 1887. Less than a dozen persons were present. But nevertheless the Institute proceeded to organize and do business, as can be seen from this abstract of the secretary's report of the session:

The minutes of a meeting held in the council chamber, Monongahela City, July 9, 1887, for the express purpose of forming a mining institute for the educational benefit of all interested in mining.

On motion of Thomas S. Hutchison, the following were appointed officers pro tem: Henry Louttit, president; Henry Kinlock, vice-president; J. L. Watson, treasurer, and William Seddon, secretary. On motion, which was seconded and duly carried, it was resolved that this institute be known as the Western Pennsylvania Mining Institute.

On motion, which was seconded and duly carried, the following resolutions were unanimously adopted: (1) That each and every member pay the sum of $1 as an initiation fee. (2) That the names of persons wishing to become members be received. (3) That Thomas S. Hutchinson, Henry Kinlock and William Seddon be appointed as a committee to prepare an address, the same to be published in the daily and weekly papers. (4) That Thomas S. Hutchinson, Henry Naylor and George Coulter be appointed as a committee on entertainment. (5) That we as members of this institute respectfully solicit and earnestly request that James Louttit be present at the next meeting and be prepared to deliver an address to be responded to by Henry Naylor.

Five other resolutions were made at the same time which are less worthy of record, but the final or eleventh we will record. (11) That the next meeting of the institute be held in Monongahela City, Aug. 6, 1887."

The entertaining committee appointed the following members to address and read papers at the meeting to be held Aug. 6, 1887: Henry Louttit, on "Pneumatics"; William Seddon, on "Motive Column"; J. L. Watson, on "Underground Haulage"; Thomas J. Hutchinson, on "Mining Engineering"; Reuben Street, "That Carbureted Hydrogen is Beneficial in a Mine"; and Aquila Underwood, on "The Influence of Atmospheric Pressure on Mine Workings."

The question: "Is Carbureted Hydrogen Beneficial in a Mine," naturally claims our greatest interest, as being absurd in the extreme, when we consider that it is the paramount duty of every mine foreman and fireboss to see that such a dangerous gas is entirely removed and no accumulation allowed to exist in the mine. In justice to Mr. Street, it is but fair to state that he was not of the opinion that carbureted hydrogen was in any way beneficial.

Among the early members of the Coal Mining Institute of America, none exercised a larger influence than James Blick, now deceased. We find that in the early days of the institute, he read a paper on "The Temperature in Mines and its Relation to Human Life."

An Early Lamp Test

At a meeting held Nov. 26, 1887, a committee was appointed to test safety lamps to discover which were most sensitive in the presence of inflammable gas. The committee appointed consisted of William Seddon, James Louttit, Matthew Creevy, Henry Louttit, William J. Mollinson and Malcolm Cochran.

In general use at that time there were only two types of lamps, the unbonneted Clanny and the Davy lamp. There were no elaborate arrangements for the conduct of the test and no attempt was made to discover the effect of rapid currents of air in permitting the passage of flame.

But the velocity of the ventilating current was at that time uniformly low, and the need existing today for this test was not then felt. The committee visited the Black Diamond Mine of W. H. Brown & Sons, and, after noting the indications given by the lamps tested, the majority gave the decision to the Clanny lamp.

All-day and Field Sessions

Up to Jan. 21, 1888, no all-day sessions were held. The meetings had been monthly and well attended, and it was thought that attendance could be assured for a full-day session. The first meeting in a neighboring mining center was held at Connellsville in the opera house of that town, Nov. 13, 1889, and the program was as follows: "A Brief History of the Western Pennsylvania Mining Institute," by G. W. Seddon; "Hoisting Machinery," by W. Gillie, and "A Brief History of the Pittsburgh Coal Field," by Henry Louttit. Thomas S. Hutchinson presided.

The meeting was a great success. The visitors were welcomed by Burgess Yard, and numerous well-wishers were present. H. P. Snyder, editor of the *Connellsville Courier*, R. J. Foster, editor of the *Colliery Engineer*, W. S. Gresley, author of a "Glossary of Terms in Mining," several of the mine inspectors, F. C. Keighley and R. Ramsey. Among others, the latter invited the members to visit the Standard mines of the H. C. Frick Coke Co. on the next day.

Institute Idea Spreads

The success of this institute animated others to imitate it. In the summer of 1890, the president, Thomas S. Hutchinson, and myself were invited to take part in the organization of an institute at Mansfield, now known as Carnegie. This institute was largely fostered by Rodger Hartley and James Blick, both now deceased. John Simpson was made president.

The Central Mining Institute

So enthusiastic was the sentiment in favor of institutes that it was proposed that they be formed in every mining district throughout western Pennsylvania. As a result, a meeting held at Monongahela, Oct. 4, 1890, resolved: "That this institute meet in Pittsburgh, at the call of the secretary, with a view to organizing a Central Mining Institute."

It must not be supposed that the institute did not have its enemies. It had many of them in its earlier years. In the latter part of December, 1890, the Western Pennsylvania Mining Institute and the Mansfield Institute held a joint meeting and formed the Western Pennsylvania Central Mining Institute. A committee to formulate by-laws was chosen. These men were: Hugh McMurry, William Barker, August Stinner and William Seddon.

The institute discussed in full the mining law of 1893, and in the early part of 1891 it considered at length Shaw's System of Signaling in a three-day's debate, after a thorough investigation had been made by a committee of the institute.

In 1893, the institute was invited to visit the Big Soldier mine, near Reynoldsville, Penn., operated by the Bell, Lewis & Yates Coal Co., and all the expenses of the visitors were paid by their hosts. Thomas K. Adams was president of the institute for four years, and did much to raise its standard and services to the mining industry.

The Ohio Mining Institute

On one occasion the Ohio Mining Institute of Mining Engineers were the guests of this organization and a return visit was made in the following year, when much hospitality was shown to the guests. Visits to mines always formed part of the annual meeting and among these might be mentioned trips to the First Pool mines of the Robbins Coal Co., as guests of General Superintendent G. W. Schleuderberg, to the Bishop mines, on the invitation of W. R. Wilson, general manager of that operation, and to the Turtle Creek mines, of the New York Gas Coal Co., as guests of General Superintendent Thomas D. Armitt.

In the depression of 1893 and 1894, the finances of the institute were seriously depleted, and Rodger Hartley, Daniel Bowden, Fred C. Keighley, Josiah Evans, Clyde W. Wilkins, William Clifford, Charles Conner, the late August Stimmer, Adam Kyle, the late Bernard Callihan, Selwyn Taylor, the late D. H. Thomas, Austin King and F. Z. Shellenburg combined to put its finances in order.

Effect of Shear on Roof Action

By R. Dawson Hall

Shear destroys the mine roof where the mine is not deep or where the measures are full of unhealed scars from extensive earth movements. The strength of the roof in shear is hardly affected by minor crevices and the rock is nearly as strong as if it were composed of test pieces such as are prepared for breakage in a testing machine.

Note—An article read before the Coal Mining Institute of America, Dec. 18, 1912, at Pittsburgh, Penn.

At the Summer meeting of 1911, I gave an account of the principles of "Roof Action," but no extended reference was then made to the importance of shear in causing roof fracture.

The Tension Over Pillars Acknowledged

Since I delivered my paper, I have been interested to notice that statements which I made relative to the roof breaking over the pillar by tension, have been further confirmed by English authorities. At a recent meeting, W. H. Pickering who died at the Cadeby explosion advocated the extraction of coal around the shaft, because otherwise the first break of the roof in longwall would fracture the measures over the shaft pillar, distort the shaft and disturb the buildings.*

If we made in America the same complete extraction as is customary in England, and in all our work took out the coal in first mining, then we should not have any doubt as to the existence of a real stress over the pillar.

What Shear Really Is

At the risk of repeating what you already know let me define shear. Shear is the sliding of one part of a body past another part by reason of a force acting in the direction of motion. When a body is destroyed by tension, the direction of force is roughly at right angles to the plane of the break but with a failure from shear, one part of the body slides past the other. The break from shear and the rupture from tension do not look alike. The first is smooth, the second, rough, one is a slide, the other a tear.

Suppose a square chamber is dug in the coal. If the roof of that working broke away from the rock covering the coal, without being strained in any way by bending, which is impossible, then we would say the roof failed from shear. In many cases the roof does break almost wholly from that cause especially when the coal being mined is not deep or when the roof is badly creviced as in the Georges Creek region.

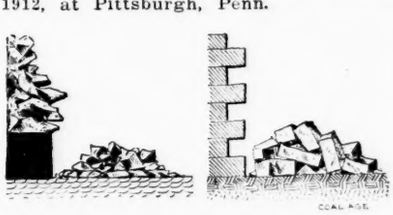


Fig. 1 Fig. 2

These Breaks Were Not from Shear, the Pieces Must Have Pulled Themselves Loose

Off-setting in Shear

In that section of Maryland the roof is badly creviced. You can see the long lines of ancient fracture passing through the slates. Consequently a piece of rock will fall whenever a rectangular prism made by four crevices is obtained or

*See Coal Age, Vol. 1, pp. 1251 and 1294.

when the load is so great that a shearing breakage results although any one or more of the four crevices are lacking and have to be supplied by a new break.

Now this breakage would go straight up to the surface in a sheer, that is a vertical cut, and sometimes it does, but as the roof lies in various strata and often each stratum has its own weak spots, the fracture usually offsets toward the vertical center line of the excavated area. See Fig. 3.

Shear Cannot Offset Backward

Since to slide successfully the rock mass must be free to move downward, the line of fracture of a true shear cannot go in a toothed manner backward and forward. It must needs offset always toward the center of the opening and this it does, and so when a shear break occurs if it is in strong roof it is almost always over the whole chamber at the level of the coal and becomes smaller and smaller as the surface is reached. How this will occur is shown somewhat clearly by the drawing of an unarched opening in brickwork (Fig. 4). The bricks in dotted lines inevitably fall out as soon as the support is removed. Where the joints are closed together the break becomes higher with a given span.

We have then the Gothic arch formation of Fig. 5. The smoothness of the fracture is rudely broken when large crevices occur, as in the western end of Maryland but are quite gentle when the only weak points are those old re-cemented crevices due to shrinkage of the shales and sandstones on drying.

Varied Nature of Crevicing

These crevice joints are large and weak or small and strong, according to their order. If they are due to the first shrinkage they are large, if to a shrinkage after the primary crevicing they are smaller, if they were formed after two series of crevices have opened, they are yet smaller and are of the third order. See Fig. 6.

The number of crevices of this character varies with the material. Strains which are adequate to shear along lines of primary crevicing will fail at secondary crevices and so on.

And moreover there are crevices due to motion of the strata during the solidification of the coal. As the peat shrank from chemical change or increasing load, it withdrew its support from the weak overburdening shales and sands with the result that the shales and sandstones were creviced. Other creviced conditions are due to side pressures resulting from the unequal elevation of the earth's surface. These lines of rupture were formed from different causes and at different times. They are therefore not by any means uniform.

Orientation of Fracture

Consequently lines of fracture in the rock and indeed those in the coal itself are not always in the same direction. At Carbondale in the anthracite region I have noticed very distinct lines of cleavage in the various beds of coal despite the fact that the beds rested one on another without even an interval of an inch of bone between them.

And in the discussion of the formation near Charleroi, at the last winter meeting we heard that two beds of coal, the Upper and Lower Freeport came together and had a separate orientation of fracture.

This is even more true of rock formation. The fracture in one bed is often at an angle of 30 deg. to the fracture of another.

Obliquity in Fracture

Lastly the fracture lines are not always vertical in the roof, with the result that a vertical strain is met by the whole strength of the rock because the material so strained is unable to move sideways. The bricks shown in the illustration (Fig. 4) are not really typical of roof because they are represented as regular rectangular parallelopipeds. This is never true of fractured roof.

Looking at the rock in the mines and realizing how often we can knap off pieces with a light hammer, we are disposed to say that neither in shear, tension or compression can it have much strength. But the pieces we strike with these light blows are free so that the rock can break along lines of least resistance. When it is in the bed, we know how much harder it is to break it and how we must vary the blow to secure an effective result.

The Unimportance of Small Fractures

In shear, owing to the fact that the crevices are neither in line, nor in the same plane nor always vertical, we obtain almost the full strength of the material. Those large crevices on which we lay so much stress are not so important.

If we remember the tremendous thickness of the rock beam, we are impressed with the fact that a crevice one foot deep is no more important in the roof strength than is a cut one two-hundredths of an inch deep in a 1-in. test sample.

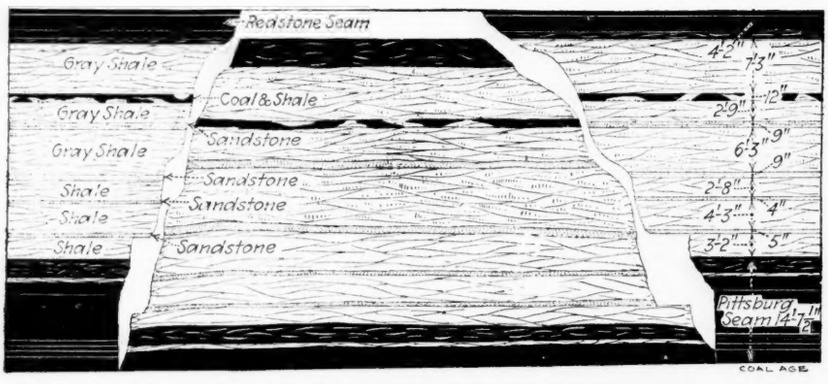
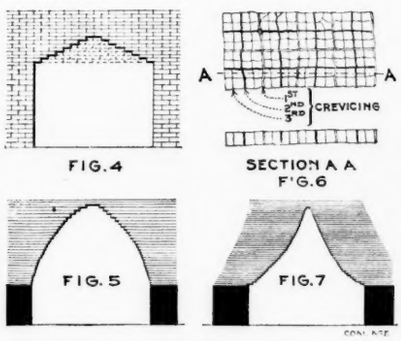


Fig. 3. A Break from Shear in the Georges Creek Region, as Illustrated by Reppert from Actual Measurements



Illustrating Remarks on the Gothic Arch Fracture

Instead of using the judgment of a Gulliver, we must regard the matter from the broader view of a Brobdingnag. In fact, too often we look at the roof from below as if it were at most 20 ft. thick and we overlook the fact that the laws of cohesion apply to the whole mass from the coal bed to the surface.

Stress Greatest at Rib

A beam fails from shear at the points of support, not in the center. The stress is greatest at the edge of the rib and zero at the center of the chamber. Of course, this only applies to shear, for the tension on a beam is greatest at the vertical centerline and as most beams break from tension, they are found to rupture at the center. But let me recall that we are now discussing shear only and not any other kind of stress.

In looking at a piece of roof which has fractured from shear we do not find the break is usually as it is in the case of the brick wall I have illustrated (Fig. 4), but we find that as the stress is greatest at the walls, the rock near the rib breaks at minor points of weakness and the fracture line is nearly straight.

Thus we have the Gothic arch shown

in Fig. 5. If the strain from shear were greatest at the center, we would tend to have a shape of rupture like that in Fig. 7 and, as everyone knows, the roof rock does not break in that manner.

Roof Does Not Always Fall Till It Chokes

A wonderful figment of the imagination is that the roof tumbles down till it chokes and that the roof ruin progresses from the mine to the surface, if indeed the surface is ever reached. Some people think that all below the surface must be completely broken up or the surface would not be disturbed.

Eli T. Connor, a consulting engineer of Philadelphia, gave me these interesting photos of the conditions under the city of Scranton. In one (Fig. 8) we see the effects of the squeeze in the Dunmore No. 3 bed, Leggetts Creek colliery, which is situated under the city of

Fig. 8. A Squeeze in the Dunmore No. 3 Bed at Scranton

Scranton, 700 ft. below the surface at this point.

This Dunmore bed is the lowest seam worked. Fig. 9 is another view of the same squeeze. Both were taken at points situated under public school No. 25, and the surface was disturbed by the mining. Nevertheless in Fig. 10 we see the face of a chamber in the Four-foot seam directly over the working places in Fig. 8, and it is still in good condition.

There are 450 ft. of measures between the two. The sagging of the rock shows at the surface and in the lowest bed 700 ft. down, but not 350 ft. below the top of the ground, as shown in Fig. 10. Clearly the destruction is not so simple as that caused by shear.

Shear Not Directed by Intelligence

I hope I have established the idea in your minds that the strength in shear of a piece of roof rock in place is nearly equal to that of a selected piece of rock tested in a machine. The condition of stress assures us that the rock in a deep shear cannot take advantage of its weakness, but must resist along certain definite planes which are not by any means determined by its condition of fracture unless the fractures are of a mammoth character.

You will perhaps be willing to grant that the distortion of shear is applied over the whole section equally. Up-to-date textbooks usually assume it to be equal until they arrive at the discussion of horizontal shear, then they tell us that the vertical shear and therefore the shear distortion in a homogeneous material is not equal over any vertical section.

In Fig. 11 the block B is shearing free from the block A, of which it is a part, and as a result the parallelopiped particles between A and B are undergoing strain under a couple P and Q. This strain converts them to rhombopipeds. These particles are represented

Fig. 9. Another Near-by View of the Same Squeeze

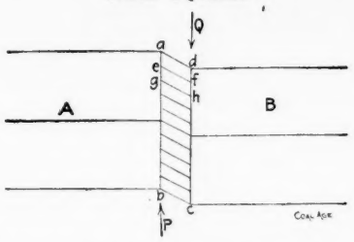


Fig. 11. Representing Mode of Action of Shear

by *abcd* and unit rhombopipeds are *aefd* and *eghf*. Now if the shearing is not equally divided over every cross-section, then each will not be equally distorted, and if *eghf* is more distorted than *aefd* there will be a vertical tension at f between the upper and the lower rhombopipeds. This condition has not been discussed, but it suggests that the modern theory regarding vertical shear is open to question.

Equality in Distortion over Cross-section

The argument that the shearing stress at the neutral surface is 50 per cent. greater than the average shearing stress, is somewhat doubtful in character, and involves conditions which hardly seem to have been duly considered. The theories regarding horizontal shear have been many, and the tenet that vertical shear, or rather its distortion, varies over a cross-section, resting as it does on a certain dubious method of determining horizontal shear, is subject to much question.

The volume which is to be sheared loose from the surrounding rock in the case of a first break is bounded by at least three surfaces. It is probably best figured as a square. In this case the area to be sheared is the depth of the surface multiplied by four times the side of the square, and if the weight of the rock is 164 lb. per cu.ft., we have

$$164\ Dl^2 = 4Dls$$

where D = the depth in feet, l = the side of the square in feet, and s =

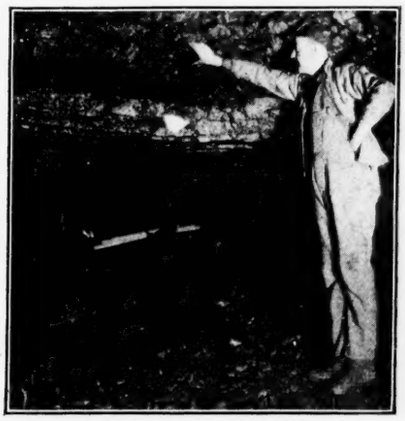


Fig. 10. Condition of Measure above that in Figs. 8 and 9

shearing strength per square foot. But Dl can be canceled and we have

$$l = 0.024s, \text{ about.}$$

Shearing Strength of Rock

Unfortunately we do not have many figures on the shearing strength of rock. I have only been able to find the following, which are culled from Henry M. Quimby's "Shearing Values in Stone and Concrete" (American Society of Testing Materials).

Material	Approximate strength in lb. per sq.in.
Gneiss	1000
Conshohocken laminated mica schist	1400
Limestone	1200
Rushland black shale	2500

A Reductio Ad Absurdum

We are on dangerous ground because these are doubtless somewhat select building stones. Consequently we will select a coefficient of inaccuracy of from 2 to 5. Understand this is not to be regarded as a safety coefficient; that should be larger. We are considering how large a chamber could possibly exist without

caving from shear, not how large it should be for safety.

We therefore take 500 lb. per sq.in., or 72,000 lb. per sq.ft., as a fair average for all the rock in a vertical section from the surface to the top of the coal.

Hence

$$l = 0.024 \times 72{,}000$$

$$l = 1728 \text{ ft.}$$

Such a condition never has existed doubtless, and this abnormal result shows that shear rarely destroys the mine roof. In fact shear rarely demolishes *any* structures of *any* kind.

In the case of mine roof, everyone seems so confident that we have a structure which invariably fails from shear. The idea is contrary to all the evidence and should be dismissed. The raggedness of roof fractures disproves it if other reasoning does not.

The Way Roof Falls

Another reason for disbelieving in the effect of shear is because roof is not destroyed instantly but by degrees. Sometimes when it falls it descends almost as fast as gravity provides, but previous to the fall "warnings" are given.

There are hollow thuds far up in the roof. If shear alone or even bending moment were alone concerned, these warnings would not be given. A growing amount of distortion would doubtless take place the longer a working place stood open, the distortion being the result of the flux of materials composing the roof under the strain.

But those sudden rendings far up in the roof, why do they not bring the mine roof down like a castle of cards? Is it not strange that the process of destruction is so slow and that even at final collapse, some time is given for the miner's escape? Only when wide areas have been extracted is the air blast severe. The rendings to which references have been made are due to the bending moment and are far above the coal and over the pillar. Why they do not result in final destruction is another problem and better left to discussion in a later paper, should you be disposed to hear it.

The Clinkering of Coal Ash

By E. B. Wilson

The proposal has been made that coals should be rated in the market not so much on their calorimetric heat value or their sulphur content as on the minimum temperature at which their slags are formed. The article describes the nature of these slags and how to determine from an analysis the type of silicate to which they will belong.

Note—Article delivered before the Coal Mining Institute of America, Dec. 18, 1912, at Pittsburgh, Penn.

The object of this paper is to describe the new harpoon being introduced to transfix bituminous coal producers and consumers and the remedies to be used to dodge and avoid being injured by it. One of the good features of any particular coal bed is that it changes little in fixed carbon and volatile hydrocarbons over large areas, but it is apt to increase or decrease in sulphur and ash.

The impurities in coal are ash, moisture and sulphur. Their injurious effects on the combustion of the fuel, which seem to be only partly understood by the consumer, are therefore reviewed in the following paper.

The Ash in Coal

Ash in coal consists of the incombustible material which was in the original vegetable matter from which the coal was formed, of the sediment in the water in which the vegetable matter was submerged, and of the material which filtered through the cover, by which the vegetable matter was later overspread.

Chemical analysis of coal ash shows that it usually contains alumina Al_2O_3, lime CaO, silica SiO_2, iron oxide Fe_2O_3, magnesia MgO, and sulphur S. There are other constituents, such as sodium, potassium and phosphoric oxides, but, as a rule, these are found in such small quantities that they are not discussed in this paper.

The Disadvantages of Ash, Moisture and Sulphur

Ash in coal detracts from its economic value as a steam fuel in many ways: First, each per cent. of ash represents 20 lb. of worthless material per ton of coal. This must be unloaded from the cars, carried to the boilers and transported away from them. Second, by occupying space, it lessens the heating value of the coal in proportion to its percentage. Moreover, it detracts from the heat-giving power of the fuel by absorbing heat units, and at times by forming clinker which prevents free combustion.

Moisture is an impurity which varies according to the absorptive property of the coal. It is fairly regular for any one bed, but even then its quantity is dependent on the exposure of the coal in handling. Moisture reduces the economic value of fuel by its absorption of quantities of heat in its evaporation. It requires a high temperature about 3000 deg. F. to dissociate steam, and in so doing as many heat units are lost as are consumed in the formation of steam. Though otherwise undesirable as an impurity, moisture does not cause clinkering.

Sulphur is objectionable in such coal or coke as is intended for use in metallurgical operations if it is present in excess of 1 per cent. While sulphur has been stated to be a clinker-forming constituent of coal, it is the reverse and prevents coal ash from clinkering. Further, it has a heating value of its own equal to about one-half of the coal it replaces, and altogether is not so objectionable for steaming purposes as has been claimed.

The Character of Coal Slags

The constituents of the ash determine whether coal will clinker on burning. These constituents with the exception of sulphur, are either in the form of basic oxides or so become on heating. They combine with the so called acid, silica, to form silicates or slag. The fusibility of the ultimate product depends not alone on the ratio of the silica to the basic oxides the slag contains, but on the properties of the bases themselves.

The silicates of some bases are more easily fused than the exactly corresponding silicates of others. For example, the silicates of alumina are for the most part difficult to fuse, fireclay being one of them, while the corresponding ferrous silicates, or those containing iron, are fused at comparatively low temperatures.

Alumina seems to require the presence of a base-metal oxide to form a slag, particularly when above 10 per cent. is present. Sometimes it acts as a base, at others as a acid; so that it may be considered as half acid and half base. The silicate with one base is less fusible than one containing two or more bases, provided the proportion of base to acid remains the same.

The principal action of iron is to form a combination with silica and this action cannot take place unless the iron is in the form of ferrous oxide. Like iron, lime acts as a base to satisfy the acid silica. Its tendency is almost always to decrease fusibility after it reaches 15 per cent.

Clinkering Qualities More Important than Calorimetric

The country has been flooded with coal analyses, both approximate and ultimate, but it is doubtful if many consumers receive the analysis of the ash in the coal they are purchasing. In many instances this information is of more im-

portance than that furnished by calorimetric tests for heat units.

To know the amount of ash and sulphur in coal is not the vital issue to consumers, for a fuel may have little ash and sulphur, and be an abominable steam coal owing to its ash-fusing or clinkering properties, while on the other hand, a fuel higher in ash and sulphur will make an excellent steaming coal.

In practical tests it has been found that the percentage of ash which is formed into clinkers, as well as the obstructed grate area per pound of clinker, hold a close relation to the fusing temperature of the ash when different coals are burned under similar conditions.

The constituents of ash when separated may be entirely infusible, but, when mixed in the varied proportions in which they occur in coal, they combine to form slags which are fusible at varying temperatures. Coal clinker is a silicate in which the oxygen in the base bears a definite relation to the oxygen in the silica.

Three Types of Silicates

Three definite types of silicates are expressed as follows, the symbol R representing any base.

$RO \cdot SiO_2$ represents a bisilicate in which the oxygen in the base is one-half that in the acid.

$2RO \cdot SiO_2$ represents a monosilicate, the oxygen in the base and acid being in the ratio of 1: 1.

$4RO \cdot 3SiO_2$, in which the oxygen in the base is ⅔ that in the acid is termed a sesquisilicate or 1½: 1 silicate. Prof. H. D. Hofman's curves shown in Fig. 1 taken from the Transactions of the American Institute of Mining Engineers, Vol. XXIX, p. 682, and which can also be found in Fulton's "Principles of Metallurgy," p. 274, illustrate this point.

In this diagram, the temperatures given are based on the melting points of Seger cones which can be relied on as being approximately correct.

Eutectic Points of Various Silicates

The melting point of a ferrous bisilicate is given in Fulton's "Principles of Metallurgy," p. 281, as 1500 deg. C. When about 8 per cent. of lime CaO is added, the eutectic or easiest melting point, 1220 deg. C., is reached; and any additional increase in lime causes the melting point to rise steadily as shown by the slag-forming curve $RO \cdot SiO_2$ in Fig. 1.

The melting point or temperature of slag formation of a sesquiferrous silicate is about 1550 deg. C. When 8 per cent. of lime is added the lowest melting point is about 1250 deg. C. and from that point, the formation temperature curve $4RO \cdot 3SiO_2$, Fig. 1, increases regularly with increase of lime, showing that it also requires a higher temperature to form slag as the lime is increased.

The mono-ferrous-lime silicate represented by the formation temperature curve $2RO \cdot SiO_2$, Fig. 1, reaches its easiest fusible point, or eutectic, when there is about 35 per cent. CaO and 65 per cent. FeO in the silicate.

The Action of Lime, Iron, Silica and Alumina

In general the rule is that an increase in lime, or the same thing, a decrease in iron oxide below that necessary to form the easiest fusible mixture increases the melting temperature or the formation temperature of the slag. An increase in silica above the proportion designated for definite slags increases the viscosity. Further, alumina in amounts greater than 10 per cent. increases the viscosity or pastiness, while ferrous oxide or magnesia has a tendency to make slags fluid.

It may be of interest to those not familiar with the calculation of slags, to know why at any given temperature one coal ash will slag while another does not, and to show this the ash constituents are assumed to form a monosilicate and such

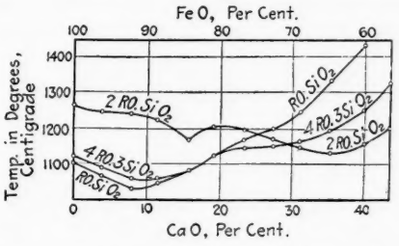


Fig. 1. Formation Temperature of Slags in Relation to Lime and Ferrous Oxide

a slag is calculated. In the formulas given R stands for the base; consequently, in the following equation representing the formation of a calcium monosilicate, it stands for the calcium:

$$\text{Lime} + \text{Silica} = \text{Calcium silicate}$$
$$2CaO + SiO_2 = 2CaO, SiO_2$$
$$112.18 + 60.3 = 172.48$$

Ballinger's Factor

From this equation we deduce it requires $\frac{60.3}{112.18} = 0.538$ part of silica to combine with one part of lime to form 1.538 parts of calcium monosilicate. The molecular weights of the materials are used to obtain the decimal fraction 0.538, which is termed Ballinger's factor for lime silicate, and the same method is followed in finding the other factors required for the calculations.

The ash analyses from two coals are taken for sample slag calculations. One a West Virginia semibituminous coal formed a thin black fluid slag, the other an Alabama coal did not run so as to cause inconvenience. The coals had the following analyses:

ANALYSES OF TWO COALS

	West Virginia	Alabama
Moisture	0.469	1.589
Volatile hydrocarbons	19.139	30.150
Fixed carbon	75.530	50.391
Ash	6.360	15.330
Sulphur	0.480	2.540
	101.978	100.000
B.t.u. per lb. of coal	14,450	13,000

The ash resulting from these coals had approximately the following analyses:

ANALYSES OF THEIR ASH

	West Virginia	Alabama
Silica, SiO_2	39.020	29.14
Alumina, Al_2O_3	23.520	15.56
Lime, CaO	19.970	20.73
Magnesia, MgO	3.265	1.91
Ferrous oxide FeO	11.140	13.42
Sulphur	0.240	6.00
Undetermined	2.845	
	100.000	86.76

The iron is given in terms of ferrous oxide but before any base will unite with silica, it must be deprived of its sulphur. As found with coal, sulphur is usually in the form of ferric sulphide or iron pyrite FeS_2, although it is possible that it may exist as a basic sulphate; at any rate one-half the sulphur is oxidized to sulphurous oxide SO_2, while the remainder forms ferrous sulphide FeS, which is exceedingly difficult to oxidize to ferrous oxide. There being 0.24 per cent. of sulphur in the ash, a certain percentage of the iron should be accounted for as forming a part of ferrous sulphide; and to satisfy the sulphur the following quantity of iron is required

$$\frac{55.84 \times 0.24}{32.07} = 0.42 \text{ per cent.}$$

and this reduced to terms of ferrous oxide is

$$\frac{71.84 \times 0.42}{55.84} = 0.54 \text{ per cent. FeO}$$

The quantity of ferrous oxide remaining to form slag after deducting iron to satisfy the sulphur is $11.14 - 0.54 = 10.60$ FeO. The quantity of silica necessary to form a monosilicate is next calculated by the aid of Ballinger's factors:

SILICA NEEDED TO MAKE MONOSILICATES OF BASIC OXIDES

Basic Oxide	Per cent.	Factor	Product Silica needed
Al_2O_3	23.52	×0.885	20.815
FeO	10.60	×0.419	4.441
CaO	19.97	×0.538	10.744
MgO	3.265	×0.748	2.442
Silica needed to transform all basic oxides into monosilicates			38.442
Silica actually present			39.02

It will be seen from this that the silica is in the right proportion to slag all the oxides and form a monosilicate The quantity of ash in a ton of this coal is $6.36 \times 20 = 127$ lb. of which lime forms practically 19.97 per cent., or 25 lb. If, therefore, 25 lb. of lime were spread over the fire during the time of burning one ton of coal, it is probable that no slag would be formed. Oyster shells or good limestone would answer the purpose but about 9 lb. more would be required or 34 lb. to the ton of coal.

A Coal Where Sulphur Prevents the Iron from Forming Slag

To show that a coal high in ash and high in sulphur, may nevertheless not slag, the ash from the Alabama coal mentioned is taken for calculation. The iron is reported as a ferrous oxide, so it is necessary to find its equivalent in metallic iron in order to ascertain the quantity required to satisfy the sulphur. The atomic weight of iron is 55.84; the molecular weight of ferrous oxide is 71.84, hence,

$$\frac{55.84 \times 13.42}{71.84} = 10.43 \textit{ per cent. of iron}$$

The formula for ferrous sulphide is FeS, and to satisfy the sulphur will require $\frac{55.84 \times 6}{32.07} = 10.44$ parts of iron, so all the available iron is used in the ash to form ferrous sulphide and none is left to form a silicate.

The United States Geological Survey's Fuel Testing Plant at St. Louis furnished the public with an immense number of analyses both proximate and ultimate with B.t.u's. thrown in, also other data on the combustion of coal, but nothing so far as the writer is aware on the clinkering of coal ash.

Evaporation Test of Coal Is a Failiure

On Nov. 18, 1911, E. G. Bailey, Mechanical Engineer of the Boston Fuel Testing Co., read a paper before the Ohio Society of Mechanical, Electrical and Steam Engineers, on the "Fusing Temperature of Coal Ash and Its Relation to Rate of Combustion," in which he says:

> The seller of coal cannot guarantee a certain evaporation in a plant because of the varying conditions affecting the boiler efficiency, but he can and does guarantee to deliver coal of a certain heating value. The seller of coal cannot justly be held responsible for trouble due to clinkers when their formation is the fault of the fireman, but the purchaser can specify that the ash of the coal delivered shall not fuse below a certain desired temperature and can see that this specification is filled. This requirement is of equal and often of greater importance than the demand for a given number of British thermal units in a pound of fuel, for the formation of clinkers may retard and prevent development of heat as clinker affects both the capacity and efficiency of the plant as well as the repairs to the furnace and its equipment.

The heat units of a coal may be determined by chemical analysis and by the calorimeter; but these methods will not determine the value of a coal under a boiler. Boiler tests such as were made at St. Louis by the U. S. Geological Survey, are of value to show what might be done under conditions which do not prevail in practice, and the results are to be accepted as the best possible for the coals tested, but in practice with the different conditions of grate bars, draft, extent of boiler-heating surface, methods of firing, kind of boiler, difference in temperature of feedwater, boiler setting, etc., the results will fall considerably below the data given.

The Excessive or Deficient Air Supply Vitiates Results

Prof. Kent, who made the Centennial Tests, says: "Boiler tests being so extremely variable, their use for determining the relative steaming value of different coals has led to false conclusions." When the economic heating value of a coal is based on chemical analysis or heat units, the assumption is that these determinations will show whether the coal will or will not perform its work satisfactorily under a boiler.

The value of any coal as a steam fuel (cannel coal excepted and slagging properties excluded) depends upon its fixed carbon and per cent. of ash. When the cause for this statement is analyzed* it will be found that there is a chemical waste which arises from too little or too much air for the total combustion of the volatile hydrocarbons.

Imperfect combustion may occur therefore, as well from too much as from too little air. It is impossible with heavy firing to furnish sufficient oxygen to approximate complete combustion even with forced draft when bituminous coal is used under boilers.

So much has been anticipated by coal consumers from good analyses and calorimetric tests and so little realized that attention has been turned to the ash which a coal produces, not because clinker has lately been discovered, but because it has more influence on proper combustion of the coal than the mere statement of proximate analyses.

Easy to Specify but Unsafe to Guarantee

It has been stated truly that the real measure of clinker formation is the difference between the fusing temperatures of the ash and the temperature to which this ash is subjected. While it is relatively easy for the purchaser to follow Mr. Bailey's advice and specify the fusing temperature of the ash, it is very uncertain whether it could be delivered.

Of course, the minimum fusing point could be obtained for the many high-ash coals which have ash which fuses with difficulty, but their use would necessitate a decrease in British thermal units. Again, some of the coals having the greatest calorific power will clinker so badly as to interfere with the draft and to prevent the realization of the full heating value of the fuel as determined calorimetrically.

Furthermore a carload of coal may furnish excellent results and yet the next shipment may form clinkers in the furnace. Of course, there are several different reasons for the change, but the fact remains that such a variation is almost sure to exist.

Conditions Making Uniformity of Product Difficult

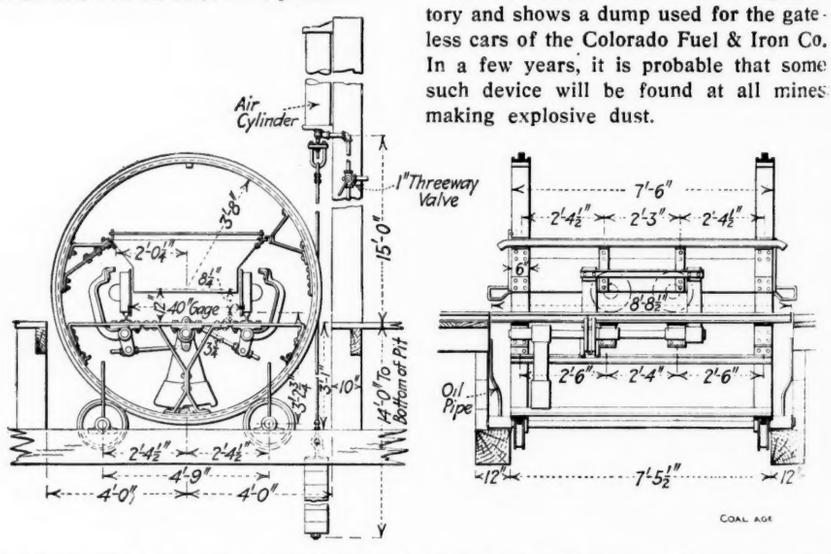
More fine draw slate, or slate parting, may have gotten mixed in the coal, or possibly the seam may contain two or more benches, the coal from which when mixed will not clinker badly, but one of which if shipped alone will form a fluid slag.

It is well to know the ash constituents of a coal because in case it should clinker unduly, there is an opportunity to correct the trouble without condemning the entire shipment and with it, the good name of the operator. Slippy coal, or coal crushed by dynamic movements, may be regarded as one whose ash will bear watching, because of the impurities between the pieces of coal.

*"Coal as a Boiler Fuel," Mines and Minerals, Vol. 23, May, 1903, p. 466.

Rotary Dumps

The illustration below is self-explanatory and shows a dump used for the gateless cars of the Colorado Fuel & Iron Co. In a few years, it is probable that some such device will be found at all mines making explosive dust.



ROTARY DUMP USED BY COLORADO FUEL & IRON CO. FOR EMPTYING GATELESS CARS

Improved Coal Washing Conditions

By G. R. Delamater*

A plea for scientific management of coal-washing plants and a protest against our present haphazard methods. The writer does not approve of compartment jigs for coal, believing in several slow speed jigs, equal in number to the compartments they replace. He calls attention to the amount of coal often carried in water which has been used repeatedly in the washing process.

*Engineer with Pennsylvania Crusher Co., Philadelphia, Penn.

Note—Paper read before the Coal Mining Institute of America, Dec. 19, 1912, at Pittsburgh, Penn.

Coal washing is a subject upon which there has been practically no discussion by the engineering societies of this country and this is to be much regretted, as it is only through open debate that rapid progress is made.

The Ideal Report on a Washery

We frequently see interesting papers descriptive of some new washer plant, but there is very little published which goes thoroughly into the more intricate phases of coal washing. For instance, it is interesting to know that a certain make of jig is used in the plant described, but that information would be of much greater value if data were given showing the screen area of each jig, the size and number of perforations of the screens used, width of overflow, depth of bed, number and length of the strokes of the plunger, water used per ton of coal washed, horsepower required and, of course, the capacity.

Then it would be interesting to know the size of the coal as washed and the amount of good coal in the refuse. Even the above stated data would not complete the needed information, as some reason should be given for all the above conditions having been arranged as, for instance, why the jigs are operated at the length and number of strokes stated, why the coal is crushed to the size given, etc.

Before any expensive equipment is purchased, or the design of the plant even attempted, the preliminary investigations of the coal for washing should be thoroughly and carefully made.

Coal Washing Neither a Science nor an Art

This, then, brings us face to face with the question of how such methods can be determined and as to whether there are any standards which may be followed. This, I think, is the unfortunate part of the present situation, for there are little or no data along these lines and there are hardly any standards in coal-washing methods or calculations.

Before such conditions can be expected the operators themselves, and the coal-company engineers, will have to take a great deal more interest in coal washing than they have shown in the past, for it is the coal companies who are paying for the losses resulting from the use of improperly designed or misplaced coal-washing machinery and other equipment; and it is but proper to assume that their position is such that, if investigation is once undertaken by them, more rapid progress will be made than can possibly be expected so long as they remain uninterested.

The Need for Washery Standards

I have talked with several superintendents and engineers, who claimed to be disgusted with coal washing in general, and who stated that they would never again open a mine, the coal from which would have to be washed. In most of such cases, a little investigation has shown that the washeries were built practically without any preliminary inquiry.

The design of the plant was left entirely to some coal-washing concern, the purchaser making no attempt whatever to verify its judgment. Had he been well informed on the subject, he could no doubt have intelligently contradicted many of the statements made by the washer company's representatives. He could either have assured himself that they were prepared to put in what was needed or could have refused to give them the contract. I do not wish this to appear as a reflection on the coal-washing concerns, as it is not intended in that way. I think anyone will admit that better bargains are made and more satisfaction always results where the purchaser is thoroughly familiar with everything in connection with the equipment to be purchased.

Washery Efficiency

We are in need of standard methods for calculating washery efficiencies, and I am of the opinion that this is one of the most important steps to be taken. In the March, 1912, issue of *Mines and Minerals* I presented a paper on that subject in hope that a discussion would be started which would result in some standard method being adopted.

I do not claim that the method therein presented must be accepted as the only correct one, but I did not publish it until after I had made use of those formulas for about two years and had had an opportunity to test them out under a great many different conditions.

The Refuse Should be Watched as Diligently as the Coal

About ten years ago, the chief engineer of a certain Pennsylvania coal company requested that I investigate their washeries and we found the washed coal quite satisfactory, but the coal loss in the refuse was enormous, that is, there was over 50 per cent. of the refuse which was just as good coal as the washed slack.

We discussed this in detail with the president of the company, but after spending about two hours in the consideration of the problem he informed us that he had no interest in anything but the washed coal, and did not care what the refuse was like. I saw this same official recently, and he seemed much concerned about the coal he was losing in the refuse.

He had reduced it considerably within the last year or two, but is not satisfied yet and says he will not be contented until he has succeeded in reducing this loss to a minimum. He is studying coal washing more carefully now and thinks there is a lot to learn about it. This is unquestionably true, as the deeper one goes into the subject the more thoroughly convinced does one become that so far we really know very little about it.

All Men Have Theories of Which a Few Are Good

I heard a few days ago of a washer boss who was asked why feldspar was used on the jigs in his plant, and he replied that the feldspar had a magnetic attraction for the slate, and particularly the sulphur, and that it pulled these impurities down through the jig screen, but had no effect on the coal.

There can be no question whether this man did or did not understand the other things about his jigs and I would not be surprised had he been questioned further, he would have stated that the pulsation was given to shake the refuse loose from the feldspar as one would shake tacks from a magnet.

However, one does not find as many washer bosses of this kind now as there were a few years ago, as most of them are using their heads to good advantage. It is impossible for many of them to accomplish much in their old washeries, and many cannot make changes because someone in authority thinks the present equipment good enough. Such men are being slowly won to saner notions, and this is very evident from the number of old washeries which are being remodeled and made more efficient.

Methods of Value in Ore Concentration Do Not Apply to Coal

I have spent considerable time in the West studying the methods used in the

concentration of ore, in hope that some of the practices of metallurgists would be applicable to coal washing. Ore-dressing processes have been carefully worked out, and there are volumes of valuable data on this subject.

The materials treated are, of course, of much greater value than coal, and much more expensive processes may be employed in their treatment than could be used for fuels. There is a great deal to be found which, at first thought, would seem of practical use in coal washing, but after careful investigation, and after making many tests, I found that a great many of their methods could not be used.

For instance, the compartment jig is found in many of the Western concentration plants and it gives highly satisfactory results. Tests made on these same machines did not give equal efficiency with coal as with metalliferous bodies and, in fact, in every case, better success was obtained with single-compartment jigs.

Buoyancy of Coal Makes Washing Difficult

The explanation of this was found to be as follows:

The very best results with the compartment jigs were on using the heavier ores, the gravities ranging anywhere from 4 to 8, water being considered as of unit gravity. Naturally, particles which have a gravity of 1.4 or even 2 sink more slowly than those of a material six times as heavy as water.

Coal having a gravity of about 1.35, even a slight disturbance of the water will cause it to move about, while materials with a gravity of 8 would be much more sluggish. There are two theories of the compartment jig which sound good, but these, after having made many tests, I am thoroughly convinced are not correct. Their faults are not evident in the washing of ores, but were readily determined on attempting to wash coal.

Compartment jigs are sometimes built with but two compartments, but more often with three and sometimes with four or five. Each compartment is practically a jig itself, but they are arranged in tandem, the washed product from the first overflowing directly to the second, and that from the second passing immediately to the third and so onward.

Now, it is claimed that the heaviest material is removed in the first compartment, a lighter in the second, and so on. As the pulsation is given in any one of the compartments, a certain amount of water passes up through the screen and must overflow from that compartment to the next ahead.

Excess of Water in Last Compartment Washes Away Clean Coal

As a result, the overflow from the second compartment is equal to the combined amount of water discharging from the two first compartments. The overflow from the third compartment is equal to all the water from the three compartments. Hence, with each added compartment, the cross flow of the jig is increased, while the strength of pulsation is the same in each.

In some types of compartment jigs, the strength of pulsation is lessened slightly with each succeeding compartment, but I will refer to these later. Remembering, then, that the heaviest material is removed in the first compartment, it seems to me that, to obtain the best results, all water action should be lessened with each succeeding compartment instead of being increased, for, as stated above, the lighter the material, the more readily is it disturbed in water.

Some compartment jigs are arranged so that the strength of pulsation is reduced with each succeeding compartment, yet this does not seem to help matters in the treatment of coal, as the cross flow still increases so rapidly with each added compartment, that a point is quickly reached where the cross flow positively kills all pulsating effect.

No Effective Pulsation in Last Compartment

Let me illustrate this. Remember, first, that the overflow water from a single compartment is equal to the water introduced into that compartment. Assume a four-compartment jig in which the pulsation is the same in each section.

Assume the water for pulsation from each compartment = 4. Then the overflow from the first compartment to the second = 4, from the second to the third = the sum of both, or 8, from the third to the fourth = 12, and the final overflow = 16. You will see that the cross-currents at the front end of the fourth compartment = 16, as against a pulsation of four in that compartment.

Is it any wonder that the lighter refuse materials, which are quite buoyant in water, are whirled across the last compartment without receiving any pulsating effect at all? Now consider the type of jig in which the force of pulsation is reduced with each succeeding compartment. Suppose the pulsation in the first compartment = 4, in the second = 3, in the third = 2, and in the last = 1. The cross flows are four in the first compartment, seven in the second, nine in the third, and ten in the last.

At first thought, this reduction in force of pulsation looks appropriate, on account of the materials becoming lighter with each succeeding compartment, yet we have just seen that with all pulsations equal, the strength of the cross flow on the fourth compartment, is to that of its pulsation, as sixteen is to four, while in the latter case, it is as ten is to one.

Now, ores are so much heavier than water that in their separation they tend to sink more rapidly and are so sluggish that even when carried along by a rapidly moving horizontal water current, they keep working rapidly downward as they travel. With coal or bone coal, however, the gravities are so much nearer that of water that they travel on a much longer arc. Again, as the water flow increases, the ripple and disturbance are also increased, and the particles are kept in such agitation from water currents in all directions that no stratifying action is possible.

I have made tests using four compartments so arranged that the pulsation could be decreased on any compartment so gradually that no perceptible change could be detected when one adjustment was made. I would start with all compartments of the same strength of pulsation and would have no trouble holding a good bed of the heavier materials in the first two compartments, but on account of the strength of the pulsations, the last two would not bed the lighter refuse.

Then I would very gradually reduce the pulsations in these, letting the jig continue to wash some length of time between each adjustment, but when the bed would at last commence to form in these two compartments, it would simply pack so tight that no stratifying action was accomplished.

One Four-compartment Versus Four or Eight Single Jigs

Nearly every one favoring the multiple-compartment jigs makes particular claim of large capacity and emphasizes the fact that it is done with one machine. It is not one machine, however, but three or four, depending on whether there are three or four compartments, and very often on this type of jig, each compartment will have a plunger on each side.

Capacity is not dependent so much on jig length as it is on width and water flow. The last is often much abused. You can flood a hundred tons of coal per hour over any jig if you use enough water, but you will not wash it. Your stratifying action is accomplished through gravity and this cannot be forced, as it is dependent on the unvarying attraction of the earth. You must give it time to do its work. Now, a multiple-compartment jig can be forced to some extent, for what heavy refuse is not caught in the first compartment may be caught in the others following, but you cannot hope to catch the bone.

Also, if the last compartments do not carry a good bed of refuse on the screen, the coal loss will be increased with every added compartment. I claim that any three-compartment jig, washing 30 tons of coal per hour, will not wash as efficiently as three separate jigs each washing 10 tons per hour, the total screen area of the three being equal to the total screen area of the compartment jig, and the width of the overflow the same. Then, you also have the advantage with the

single jigs of the opportunity of washing separate sizes on separate jigs if that is found advisable.

I had occasion, a short time ago, to make some tests in a washery in Pennsylvania and found a rather interesting condition which illustrated so well the manner in which coal is lost in many plants, and yet how easily that loss could be reduced if the trouble were only taken to locate the exact cause.

Coal is Lost in Water Which Is Repeatedly Re-used in Washing

The washed coal from the jigs went through a sluice to the sludge tank. The water in this plant is used over and over again, the suction pipe from the centrifugal pump being connected direct with the washed-coal sludge tank. The discharge from the pump was direct to the jigs and about 90 per cent. of the feed water entered the jigs through the plunger compartment, or below the jig screens.

As a result, any coal circulated with the water entered the jigs below the screens and went to the refuse. I took samples of the waste every hour throughout the day. The sample taken at the end of the first hour showed but a slight trace of coal, that of the second hour about two per cent., the third hour a little over four per cent. and so on until, just before closing down at night, the refuse contained over 50 per cent. coal. The average of the day's run was 23 per cent.

The cause of this loss was as follows: After the sludge tank had stood undisturbed over night, all the fine coal had settled to the bottom and was removed by the scraper conveyor when the plant was started in the morning. This was very evident from the samples of washed coal which were also taken hourly, and the first sample taken contained a great deal of fine sludge coal.

We had also noted that during the first 10- or 15-min. run, the washed-coal elevator buckets were filled with sludge coal. The water in the sludge tank being quite clear at the start in the morning, there was no appreciable coal returned to the hutches of the jigs with the water pumped from the washed-coal sludge tank.

However, as the day progressed, the amount of fine coal in suspension in the sludge-tank water slowly increased until, during the last hour's run, the water pumped to the jigs carried an immense amount of this coal back to the hutches.

This is a condition which, though existing in many washeries, can be overcome in a properly designed plant, though it is sometimes hard to do so in a completed washer without the expenditure of much money. In fact, the design of some plants makes it almost impossible to overcome this trouble without practically rebuilding.

The Huron Plant

I think that without doubt, the best designed washery I have ever seen is that known as the Huron Plant of the Keystone Coal and Coke Co., near Salemville, Penn., on the Alexandria branch of the Pennsylvania R.R. It was designed under the direct supervision of E. C. Taylor,* who is superintendent of both the Salemville and Huron Plants.

Everything about the Huron washery indicates that a great deal of forethought was given the design by Mr. Taylor before the plant was built. His experience with the older Salemville washery placed him in a position to know just what was needed to wash the coal, and I understand that he spent considerable time experimenting in the old plant and making many changes therein in order to reduce the coal losses as much as possible and to overcome other faults of the plant, such as excessive repair costs, etc.

He succeeded in making a big reduction in the repair bills and in doing away with considerable unnecessary equipment and strengthening up that of the balance which was weak, but he states that it is impossible to overcome every fault without practically rebuilding the entire plant. However, both the Huron and the Salemville plants are today discharging refuse of which there is less than four per cent. coal, and this is remarkable as compared with other washeries. Mr. Taylor says that the repairs on the first year's run of the Huron plant were only about five per cent. of those of the first year's run of the Salemville washery.

Economy, Safety, Convenience and Cleanliness

The design and construction of the sludge tanks is an entirely new departure and results in nothing coarser than 20-mesh coal being carried away by the overflow water, which is pumped back to the jigs. The operating floor is roomy, with no drive chains, gearing, or other dangerous part of the equipment in the way.

By an ingenious combination carried out in the building design, an abundance of light is obtained around the jigs from a double row of windows, one above the other, and every part of the jig room is well lighted. This may also be said of all other parts of the building. One man operates and controls the ten jigs.

His duties do not take him from the operating platform in front of the battery, and from here he has an absolute control of the hutch gates, water supply, coal feed and the refuse gates of each jig. The spindles of the drain valves on the sludge tanks are all extended up above the floor level, and can be opened or closed without going down through all the muck to turn them, thus making washer tending less unpleasant.

It might be well to mention here, however, that the layout of the plant is such that all parts of the building may be washed out with the fire hose and there are no dirty or inaccessible places in the building. The dry-coal bin and around the crushers is, of course, dusty, but this is entirely confined by itself and none of this dirt can get to the jig room or around the wet-coal end of the plant.

Standardization of Parts

The bucket elevators are so arranged that complete inspection of any part is possible, even when in operation. Break or weak pins are used extensively on all drives and in case an elevator becomes blocked, the pin will break before some other part of the elevator is injured. This, no doubt, saves the company many a repair bill.

Throughout the plant all gears, sprockets, chains, etc., are made alike as far as possible. Owing to this arrangement, comparatively few extra parts need be kept on hand, as one sprocket, for example, will fit in many places. With a plant having no two sprockets or gears, etc., alike, practically a duplicate plant would be necessary if replacement parts were kept on hand.

As this means the tying up of much money, all parts are seldom kept in stock at such a plant, and when something breaks for which no duplicate is at hand, it often results in an expensive delay before a new part can be supplied.

Equipment for Its Own Sake

In the past, more attention has been paid to the cost of the proposed plant than to what was in it, or the proposals of the manufacturer have been viewed from a standpoint of which specification promised the most machinery for the money. This often resulted in loading a plant up with a lot of unnecessary equipment.

Another proposal of which the price was the same did not show as much machinery, but the money was put into better construction and design of sludge tanks, jigs, water-circulating systems, etc., and was really more desirable, though not accepted. You must be thoroughly familiar with the whys and wherefores of equipment to understand its value, otherwise it may look to you as though an excellent proposal offers little for the money.

No doubt many of you read the foreword published in the Nov. 16 issue of Coal Age. This, I think, was written by an Alabama engineer. It seems to me that he hits the nail on the head and that many owners of washeries could well afford to read that foreword over carefully and see if some of the methods of which he speaks would not apply to their own plants.

*See Coal Age, Oct. 26, 1912, Vol. II, p. 572, for an article by E. C. Taylor, with illustrations of plants and remarks on washery practice.

The Kentucky Mining Institute

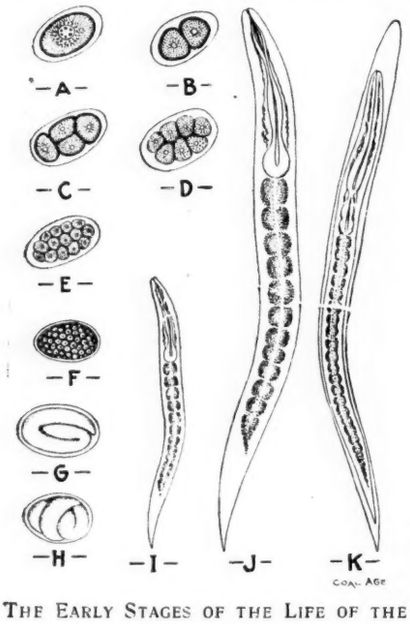
Abstract of papers read before the Kentucky Mining Institute at its Winter Session, held Dec. 9 at the College of Mines and Metallurgy, State University, Lexington, Ky. The gist of all the papers is given in as few words as possible.

Hookworm

By Dr. J. W. Pryor*

The hookworm disease is due to the presence, in the intestinal canal, of a parasite *ankylostoma duodenale*. The American variety of this worm is known as the *necator americanus*. Among other symptoms of the infection, anæmia is usually pronounced. This arises from loss of blood and the presence of a poison which the hookworm injects into the circulation.

The patient has the general appearance of ill health, including a pallid skin, and when the disease is incurred early in life, it retards physical and mental development. Among other symptoms are loss of desire for food or at least a capricious appetite, occasional pains in the



The Early Stages of the Life of the Hookworm

abdomen, headache, weariness, lack of interest in work and an indisposition for any labor involving exertion. The disease is often fatal.

How to Diagnose the Disease

It is easy to see the worms in the feces of hookworm carriers if it is examined by the microscope. The females lay their eggs in the small intestine and they are expelled with the feces. In order that they may develop, light must be absent, oxygen present and the temperature between 71 and 95 deg. Fahr. There must also be a moderate amount of moisture.

Eggs have been known to develop in mines at a temperature of 68 deg. It is possible for the ideal condition for development to be found within a mine. Freezing does not always destroy the eggs, but they are easily destroyed by drying. Under favorable circumstances, the ova will develop in 24 hr. and the larvæ will hatch out.

In two or three days they shed their skin. This is called the first ecdysis. After about five days from their hatching, the worm passes through the second ecdysis, but does not cast its skin. It is then said to be encysted. It has now reached that stage of its development at which it can infect the human organism.

The Head of the Hookworm, Showing Its Hold on the Intestine

The Egg of the Hookworm

The egg *A* looks like any other ovum. Like other ova, it shortly develops two cells *B*, then four *C* and seven *D*. It later reaches even further stages of segmentation *E* and *F*. A little later we see the embryo within the shell *G* and *H*, then the same shortly after when the shell is cast off *I*. In other illustrations we see the embryo several days old *J* and ready to enter the human body *K*.

The worm enters always by the mouth directly or indirectly. It may possibly be carried by flies, like typhoid. Claude A. Smith placed mud containing encysted larvæ on the arm of a man who allowed it to remain there one hour. In eight minutes he complained of itching and the irritation continued. On the fifth day his hand was severely inflamed and a section of the skin showed the larvæ present. This irritation has been called "ground itch," "dew poison" or 'toe itch."

The Itinerary of a Parasite

When the larvæ are brought in contact with the skin and remain long enough, they bore through it and thus they get into the circulation. Finally they reach the lungs, but they are unable to pass through the capillary blood vessels, so they bore through to the air cells. Thus they get into the bronchial tubes. They finally reach the mouth, being ejected from the tubes by coughing or being carried by the natural flow of mucous from the air passages. Many of them are swallowed and passing through the stomach unchanged they enter the small intestine where they undergo complete development.

In four or five days another and third skin shedding begins and they acquire a buccal capsule (a bladder-like mouth) which enables them to fasten on to the mucous membrane by sucking in a plug of the epithelium (or outer lining). In another four or five days, the fourth ecdysis begins and the last skin is shed. The worm is about ⅛ in. long and grows rapidly to its full size and length, which is about ⅝ inch.

Importance of Drastic Measures

When we understand that there may be thousands of these worms each drawing blood from the intestines, we can readily see how the patient may be weakened. When we read that each female may produce thousands of eggs per day and that in cases millions of eggs are evacuated with each stool, we can see how fast the infection may spread.

The feces of every member of every family in the state should be examined for the disease and every case treated. Above all, all persons, who are found to have it, must after treatment submit their ejecta to frequent observation for months to determine if all the worms are destroyed. The sanitary condition of the mines and camps must be carefully guarded. Reasonable regulations must be made and observed at every mine, and all manure should be scattered.

*Professor of anatomy and physiology, State University of Kentucky, Lexington, Ky.

First Aid in Kentucky

By Walter L. Moss*

There are, I believe, only two companies in Kentucky having first-aid teams, viz: the Continental Coal Corporation and the Stearns Coal & Lumber Co. A few years ago we brought injured miners out of the mines, wrapped in brattice cloth or dirty clothes, their injured parts covered with dirty handkerchiefs and their cuts plastered with fresh quids of chewing tobacco.

But at our mines today conditions are different. Seventy men out of 1800 on our payroll have diplomas for proficiency in first-aid work. Each man is

*Vice-president and general manager, Continental Coal Corporation, Pineville, Ky.

furnished with a pocket first-aid outfit, which he is expected to carry with him in the mine at all times.

The Bureau of Mines is to be credited with beginning first-aid work in Kentucky. Not until after the rescue mine car of the bureau visited this state were first-aid corps formed. When we had a meet at Pineville, Ky., 3000 persons attended. Prizes of gold coin and medals were given. We had a schedule of our own for discounting teams, but hereafter we shall use those adopted at the National First-Aid Conference held at Pittsburgh last October.

The operator who furnishes first-class houses and sanitary conditions, good schools and churches will get the best class of labor and the highest efficiency from each man. Our company by providing these necessities, was able to make its tonnage per man over 20 per cent. greater than that obtained by individual management in the fiscal year just ended.

Preparation of A Domestic Coal

By J. D. Rogers*

In the eastern Kentucky coal field, which covers several counties, there are many persistent coal beds of more or less commercial value. In some parts of the field the seams are thick, in others thin and only in local areas is development possible.

Millers Creek or Elkhorn Seam

At Van Lear, Ky., on the Levisa Fork of the Big Sandy River, 68 miles below Ashland and 3 miles below Paintsville, the Consolidation Coal Co. opened mines about three years ago on what had been previously known as the Millers Creek field. The most valuable bed in that field is known as the No. 1 or Millers Creek seam.

It is a generally accepted fact that the coals of the Millers Creek field are identical with those on Elkhorn Creek and on the headwaters of the North Fork of the Kentucky River. The coals in these latter fields are known as the Elkhorn coals and in structure and characteristics are very different, though viewed geologically they are the same beds.

David White says that the Elkhorn coal beds probably belong to the lower portion of the Kanawha formation, and the upper Elkhorn is in the same or an almost identical geological horizon with the Peerless or Cedar Grove coal on the Kanawha River in West Virginia. At Elkhorn, this seam is considered as occurring about 1000 ft. above the Lee conglomerate.

*Superintendent of mines, Millers Creek division, Consolidation Coal Co., Van Lear, Ky.

The "Miller Creek Block" is a splint coal, remarkably hard, blocky and brittle and a "good shipper." It will stand stocking for an almost indefinite time without weathering. It is a high-volatile, quick-burning coal and is a most desirable fuel for domestic use. The thickness of the seam varies from 36 to 54 in. with no partings. It has pronounced butt and face cleavages, which must be utilized in mining. All rooms are worked on the face of the coal.

Two Kinds of Coal in One Bed

A vertical section of the seam shows two different and distinct kinds of coal, the upper bench, varying from 18 to 36 in., being a hard blocky splint almost semi-cannel, while the lower 18 in. is of a softer nature, very pure and resembling a strictly bituminous coal.

This lower coal when mined breaks into comparatively small pieces, makes a good smithing coal and to a certain extent will coke. It might be noted here that though the thickness of the seam varies, this lower bench remains practically 18 in. thick, the increase or decrease being almost entirely on the splint coal.

All coal is cut by electric chain machines, the Sullivan 6-ft. low-vein machines predominating. Electric motors are used both for gathering and main haulage.

The Old Conditions

The bituminous coal trade has changed radically during the past five years. Previous to that time, picking tables, loading booms, washers, etc., were associated solely with anthracite tipples. Bituminous coal was considered too cheap to warrant any such expenditures of time and money. When one operator introduced the preparation of coal, the other was compelled to follow suit, for preparation without quality succeeded in defeating quality without preparation.

Originally our tipples were equipped with stationary 16-ft. screen bars spaced according to the grade of lump coal desired—1¼-in., 2-in., 3-in., 4-in., or 6-in. lump. Upon dumping a mine car of coal, the lumps passed over these bars, letting the finer grades through, thence into a basket at the lower end of the chute and was dumped into the car.

Owing to the fact that all kinds of equipments are furnished by the railroads, it was extremely difficult to regulate the height of the basket so that the lumps would not fall from 6 to 10 ft. into the bottom of the gondola or hopper, as the case might be. The resulting breakage caused a considerable percentage of loss to the customer which in the end we usually had to stand. In addition to this there was also a certain amount of fine coal carried over the screen bars with the lump which also found its way into the railroad car.

The egg, nut and slack grades were all prepared from what passed through the 4-in. screen bars. This was received on a double-decked knocker screen of the same length as the bars, the upper deck being covered with plates having 2-in. circular perforations and the lower ¼x2 in. The grading in its simplest form was as follows:

STANDARD FOR SIZING DOMESTIC COAL

Over 4-in. bars	Lump
Through 4-in. bars and over 2-in. screen plates,	Egg
Through 2-in. screen and over ¾-in. screen,	Nut
Through ¾-in. screen,	Slack

This method of preparing our smaller grades also got us into trouble. Providing the coal as it came from the mines was perfectly dry, everything worked fairly well and a good grade of egg and nut was secured but as fully 50 per cent. of our output was wet, the resulting grades were unsatisfactory. Too much slack stuck to the egg and nut and found its way into the railroad car.

To obviate this difficulty and to obtain the promised increase of 25c. per ton we practically remodeled our entire screening and loading arrangements. Our lump coal is now received on the screen bars as before, thence it passes to a shaker screen with 3-in. perforations in the bottom which in turn delivers it to a loading boom and picking table combined. This process practically frees the lump from all slack.

The loading boom is controlled by mechanical devices so that the man operating it can raise or lower the end at will, so as to insure that the lumps will never fall vertically into the car. As the loading proceeds and the car is dropped down the end of the boom is raised or lowered to suit and the lumps roll off, never falling more than 2 or 3 ft., and usually less.

We have never reached the capacity of this arrangement, though we have handled the 4-in. lumps from 200 tons of run-of-mine coal per hour, and it has delivered the coal without any delay. We now think we have about as good preparation as it is possible to secure for this kind of bituminous coal. The fact that we have no more complaints is conclusive evidence that the new arrangement has greatly aided us in satisfying our trade.

We have not done much to increase the quality of the egg and nut grades, partly because the tonnage is small, but principally because the original designs of our tipples will not allow much change. However, we did make two knockers out of the original one and also added another to deliver the egg coal to the car. Every opportunity is taken to run this coal over extra screens, and all chutes have perforated bottoms so that by the time the coal is delivered to the car it is practically free from slack.

Relative Hazard of all Vocations in Relation to Mining

By Hywel Davies*

Coal mining is not by any means the most dangerous of vocations, yet its toll of human lives is immense. It is said that peace has its victories even more than war but the same may be said with equal truth in respect to repeated disasters.

To show that coal mining does not stand on a peculiarly unfortunate relation to other occupations, I quote the German tables.

GERMAN PERCENTAGE OF ACCIDENT

Industrial Classes	Deaths	Slightly Injured	Partial Disablement	Complete Disablement
*Agriculture and horticulture	30½	43½	45	32½
Iron and steel industry	7½	10½	13	13
Mining	19	8½	6	5
Building construction	8½	7½	6	5½
State employees and railroads	8½	4	4	18
Wood industry	2	3½	3½	1
Warehouses	2½	2	2¼	2¼
Quarries	2½	2	1½	3
Textile	1	2	2½	1
Excavations	2	1½	1½	4¼
Teaming	2½	1½		
All other industries	13½	13½	15	14½
Total per cent	100	100	100	100

Analysis—

	Industrial	Agricultural
Hazards of occupation	43	33
Employer's fault	17½	18⅔
Worker's fault	29¾	25
Employers' and workers' fault	10	23⅓

* Note specially the surprising ratio of agricultural casualties.

The British relative hazard of occupation other than agriculture is shown for the year 1908 as follows:

RELATIVE PERCENTAGES OF BRITISH OCCUPATIONAL FATALITIES

Industries	Deaths per M employed
Home shipping trade	1¾
Docks	1½
Mines	1¼
Quarries	1
Railways	1
Building trade	0.9
Factories	¾
British home and foreign shipping trade:	
Deaths on sailing vessel trade	12.69
Deaths on steam vessel trade	4.45

To offset these foreign statistics we are woefully lacking in general as well as in detailed statistics of accident, except in relation to mining and railroads. The records in these two departments are fairly complete and are published from time to time and cause much popular indignation.

The public at large is responsible for deaths from preventable diseases, and from the German experience we learn that for one person dying of an industrial accident, the following individuals die from the various causes mentioned:

*President, Mine Owners' Association of Kentucky.

COMPARISON OF FATALITY RATES FROM PREVENTABLE DISEASES WITH THOSE FROM INDUSTRIAL ACCIDENTS

Cause	Relative Number of persons
Tuberculosis	12
Pneumonia	9
Typhoid fever	3
Measles and scarlet fever	2
Diphtheria	1½
Suicide nearly	1½

German deaths caused by occupational accidents have practically doubled since 1890, when they numbered only 45 per 10,000 deaths in the empire, but in 1908 the latest record shows the number had grown to 80 per 10,000 deaths, or 0.8 per cent. of the total annual deaths.

It is impossible to give parallel figures for the United States, as it is unfortunately true that our Census Bureau does not furnish such prompt and complete analyses of deaths. The following list is taken from the census of 1909:

AMERICAN FATALITIES

Cause	Persons Killed
(1) Railroads	6659
(2) Drowning	4558
(3) Burns and scalds	3992
(4) Injuries at birth	3508
(5) Horses and vehicles	2152
(6) Coal mining	1779
(7) Street cars	1723
(8) Gunshot and other wounds	944
(9) Sunstroke and heat	816
(10) Autos	632

Note—Coal mining occupies only sixth place.

It is important the country at least should know that coal mining, which is considered an extremely dangerous vocation and which employs 750,000 men, is sixth in the order of causes resulting in violent death.

The government should be fair to the mining and other industries, and not exploit only those accidents which are supervised by commissions or tabulated by bureaus.

Analyses of the casualties or industrial accidents with such meager statistics as we have for the United States show the following relative hazards of vocations for the ten years ending 1906:

Occupation	Deaths per M. employed
(1) Gloucester fishermen	11.7
(2) R.R. trainmen	7.46
R.R. switch and flagmen	4.50
(3) Iron mines of Michigan	4.25
(4) Anthracite mines of Pennsylvania	3.18
(5) Lead and zinc mines of Missouri	3.01
(6) Gold and silver mines of Colorado	2.85
(7) Copper mining and quarries	2.80
(8) Bituminous coal mining	2.77

Comparing the records of Western states with Southern, we readily see why Western metal miners regard coal mining as more destructive of life than mining ore deposits.

AVERAGE FATALITIES IN BITUMINOUS MINES IN CERTAIN STATES

	Recorded Years	No. killed per M. employed
All states	42	3.08
Utah	15	11.67
New Mexico	14	7.25
Washington	17	6.40
Colorado	20	5.51
West Virginia	25	4.62
Tennessee	18	4.38
Kentucky	22	1.71

The eastern field of Kentucky covers 10,000 square miles and employs about 50 per cent. of the miners in that state, mining 40 per cent. of the coal the whole state produces.

This region has never had an explosion so disastrous as to kill over five men at one time, but two-thirds of the mining accidents in the state occur in this field, principally from falls of roof.

Western Kentucky includes 6000 square miles of the southeastern corner of the great Central Coal Field. It produces 60 per cent. of the coal or about eight million tons per annum and employs nearly 12,000 men. This district deserves special consideration as it is almost as large as that of Great Britain, Germany, Belgium and France together and has a mining record as free from accidents as any part of Europe.

Taking an average for 13 years ending in 1905 (according to Bulletin 90 of the U. S. Bureau of Labor), we find that the number killed in the mines of western Kentucky is only 1.05 per thousand employed while the following are European averages:

Country	Period Covered, years	Ending	Deaths per M. employed
Belgium	20	1906	1.21
France	10	1910	1.25
Great Britain	16	1906	1.35
Prussia	14	1904	2.30

The latter is one-third higher than the average on account of the Courrières Explosion, which killed more than 1200 men and is the leading disaster in the history of mining.

Western Kentucky not only holds the record for fewer fatal accidents per thousand employed of any coal field in the world, but in addition produces a much larger tonnage per death. Thus in 1906 the production per death was as follows:

Country	Tonnage per Life Lost
United States	about 180,000
Great Britain	about 230,000
Belgium	nearly 240,000
France	nearly 240,000

These were the best records for the European countries in several years. Kentucky as a whole, for over 10 years has produced 300,000 tons for each life lost and western Kentucky extracted over 800,000 tons for each fatal accident. The largest company in the latter region mined an average of 1,100,000 tons per annum during the last 10 years and only 10 men were killed in that time.

Finally falls of roof occasion 50 per cent. of the fatalities in the United States. Bulletin 333 of the Bureau of Mines gives the following comparison of deaths from this cause:

FATALITIES FROM ROOF FALLS

Year	Country	No. per M. employed
1906	Belgium	0.40
1906	France	0.42
1906	Great Britain	0.63
1906	Germany	0.93
1906	United States	1.57
1911	Western Kentucky	0.25

*Three men were killed out of 12,000 employed in western Kentucky during 1911.

The West Virginia Mining Institute

By A. T. Shurick

A synopsis of the annual meeting of the West Virginia Coal Mining Institute held at Parkersburg. Mr. Neil Robinson was elected president to succeed Mr. Frank Haas. A number of valuable papers were presented and actively discussed. The technical press was severely criticized for its attacks on the Bureau of Mines.

The annual meeting of the West Virginia Coal Mining Institute was held in the assembly room of the Chancellor Hotel, at Parkersburg, W. Va. The first session was called to order promptly at 2:30 p.m., on Tuesday, Dec. 10, by President Haas of the institute, who introduced Frank S. Smith, president of the Parkersburg Board of Commerce. Mr. Smith, in a brief address, extended a hearty welcome to the visiting members in behalf of the residents of Parkersburg, to which Messrs. Neil Robinson and J. C. McKinley responded with a few appropriate remarks.

Election of Officers

The business of electing new officers was then taken up. J. E. Paul, of the Bureau of Mines, nominated Neil Robinson for the presidency, stating at the same time that it was to be regretted that the constitution of the institute prohibited the renomination of the present encumbent, who had so ably discharged the duties of his office. The nomination was seconded and unanimously carried. The following officers were then elected in rapid succession:

Secretary-treasurer, Prof. E. N. Zern, of Morgantown.
First vice-president, George T. Watson, of Fairmont.
Second vice-president, John Laing, Charleston.
Third vice-president, R. S. Ord, Landgraff.
Fourth vice-president, J. F. Heeley, Elkins.
Fifth vice-president J. C. McKinley, Wheeling.
Executive committee, Lee Ott, of Thomas; Prof. C. R. Jones, Morgantown; J. J. Lincoln, Elkins; Daniel Howard, Clarksburg.

J. C. McKinley then suggested that the next meeting of the institute be held during June at Wheeling, as the Semi-Centennial of the state is to be celebrated there at that time. He also stated that he favored holding only one annual meeting, and discussion on this latter point was taken up. The question was ultimately laid on the table to be taken up at the next meeting.

The afternoon session was concluded with the presentation of a valuable monograph on "Conservation in West Virginia," by the retiring President Haas. The paper brought out some novel and unique ideas on this much discussed problem. In discussion, E. W. Parker, of the U. S. Geological Survey, stated that the waste gases from the Connellsville region alone were sufficient to run all the trains on the Pennsylvania R.R. between Pittsburgh and Harrisburg.

The evening meeting was called to order at 8:05 p.m. in the auditorium of the Y. M. C. A. by retiring President Haas, who then withdrew in favor of the newly elected President Robinson.

A Valuable Paper on Ventilation

A paper on "Common Sense Mining Ventilation for the Saving of Horsepower in Operation of Mine Fans," by J. C. Gaskill, assistant consulting engineer, Consolidation Coal Co., was read and precipitated an active discussion. A number of practical and novel departures from the usual practice were described, and these were so aggressively attacked by different members that the ingenuity of the author was taxed to maintain his point.

The next number on the program was an interesting and informal address by J. E. Beebe, on the "Value of Organization." This was followed by stereoptican views of the Westinghouse works, in East Pittsburgh, accompanied by explanatory remarks by W. W. Slocum. By courtesy of the Bureau of Mines, three moving-picture films were then run and briefly described by J. E. Paul, of the department. While apparently designed more for the benefit of the general public at large, and along rather spectacular lines, they nevertheless proved of considerable interest to the institute.

The morning session on Wednesday, Dec. 11, was called to order at 10:25 a.m., with the new president of the society presiding. The opening paper was presented by C. R. Jones, of the West Virginia University, and was entitled "The Progress Made by the Department of Mining Engineering at West Virginia University." Mr. Jones concluded his paper with the request that the institute express an opinion regarding certain appropriations which the university is contemplating asking from the state; after debating the question at some length a committee, headed by ex-Governor Fleming, was appointed and instructed to draft a set of resolutions covering this point.

Mr. Jones then stated that he would like the advice of the different members regarding the short courses in practical mining which the university has been working on for some time. While no difficulty was experienced with the higher branches, there was considerable difference of opinion as to what the practical miner's course should consist of.

The morning session was concluded with an interesting paper, by G. A. Burrell, of the Bureau of Mines, entitled "Notes on Some Mine-Gas Problems." The article gave some valuable and original data on several of the different gases.

Reports of the Committees

At the beginning of the afternoon session, the resolutions drawn up by the committee on appropriations for the University of West Virginia, appointed in the morning, were read and adopted. H. A. Wiliamson, secretary, Engineering Department, Consolidation Coal Co., read a paper on the "Relation of Forestry to Coal Mining." The article is along the lines of conservation and deals with a subject of importance to the industry.

Chairman Ott, of the committee appointed to draft resolutions of thanks and appreciation to retiring President Haas and Secretary-Treasurer Day, as well as the Parkersburg Board of Commerce, read his report. This was unanimously and enthusiastically adopted. President Robinson stated that half a day at the next meeting would be set aside for the discussion of gasoline motors in mines. He also suggested the questions of moistening mine air and reversing mine fans as pertinent topics for discussion. The latter subject has already been quite thoroughly covered in the recent issues of Coal Age.

Josiah Kealy presented a brief, but interesting paper on "The New Loader," in which he reviewed the labor shortage now so acutely evident in all parts of the country and suggested ways and means for increasing the capacity of what men are available. A somewhat similar paper by the same author appeared in last week's issue of Coal Age, under the title of "When Loaders are Scarce."

The concluding paper of the meeting was entitled, "Is the Bureau of Mines Worth While?" and was written by William H. and Sim Reynolds. The article is essentially a justification of the Bureau of Mines, and it consistently refutes various statements appearing recently in the technical and trade journals of the country. It was especially bitter in its denunciation of a "near-humorous story as told by one Hogan," which appeared in a well known technical monthly. The article appears on page 874 of this issue.

The session closed with an enjoyable smoker in the evening at the Elks' Club at Parkersburg.

Conservation in West Virginia

By Frank Haas*

In this paper Mr. Haas takes a somewhat different view of existing conditions from that depicted by demagogues and writers in the popular magazines. He shows that while the mine owner recovers 80 to 95 per cent. of the coal in the seam the consumer frequently wastes fully 94 per cent. of its heat energy.

*Consulting engineer, the Consolidation Coal Co., Fairmont, W. Va.

We have heard, and are still hearing, much about the Conservation of our Natural Resources. It has been the subject upon which statesmen have discoursed for hours, multitudes of articles have been written, politicians have harangued, and alarmists have bewailed the fate of future generations; in fact, it has been the favorite subject of discussion in recent years.

A Unique Subject

The subject is unique in the fact that there appears to be but one side to the argument. No one has been so bold as to state that conservation is not a good thing, and it appears, as in many other cases of difficult understanding, that the arguments, *pro* and *con*, do not start from the same premise; in short, there may be more than one definition for conservation.

Let us look into our own state, and particularly into the coal-mining industry, and see if we can find what conservation really is and whether we have been guilty of this undefined and unpunished crime.

We have in this state a comparatively large area of the carboniferous series of stratifications which furnish all the kinds of bituminous coals of the Eastern states. Nature has seen fit to endow West Virginia within these carboniferous strata with coal seams in extent and quality equal to any similar area in the world.

At first glance it would appear that West Virginia had a store of untold wealth in her coal fields, and were we to consider only the taxable property thus made available and the population attracted by its operation, this would be true. But viewing it strictly from the point of a political economist, we must confess that coal lands have no value unless the means for their development are at hand.

Those who consume coal and are not familiar with its mining, estimate the value of fuel by what they have to pay for it, and if we consider those who live in Boston, who pay four dollars per ton, or those in San Francisco, who pay eight dollars a ton, we can readily conceive of their impressions of conservation when they hear, as they recently have, from a prominent authority in Washington, that we are wasting half our coal. The statement of this authority may be correct, but in justice to those at whose door this apparent crime is laid there should be some explanation as to how and why this is the case.

While the coal-mining industry admits its still crude methods and a lack of complete comprehension of the laws of nature with the losses resulting therefrom, yet it can pride itself on much advancement in this respect in recent years, and West Virginia particularly can compare itself favorably with any other state in the Union or even foreign countries.

The articles which we so frequently read in newspapers and periodicals are, for the most part, penned by book economists who draw too largely from the literature of the past, while the favorite assertion that enormous piles of slack at the mines are going to waste is purely a myth, at least so far as West Virginia is concerned.

Conservation is a very broad term, particularly when applied to the coal industry. To get a comprehensive knowledge of the subject it must be studied from the coal as it exists in the ground to its final utilization by the consumer. In my opinion, that part of the lack of conservation chargeable to actual mining alone is a very small portion of the whole.

Natural Conditions Are Favorable

There is perhaps no area of equal size underlaid with coal in which the natural conditions are so regular and uniform as in the fields of West Virginia. No true fault of any magnitude is known to exist. There are no folds or over-throws so common in most coal fields which make mining so difficult and dangerous. The beds are comparatively without inclination and it is only in a few localities where the grades are excessive. The Pittsburgh seam of coal which we share with Pennsylvania and Ohio has no equal in persistence of thickness and character, nor in the favorable conditions for removal.

All of these facts would indicate that from a purely mining standpoint there exists a decided advantage favoring the highest possible degree of extraction.

We have reason to believe that in many parts of West Virginia true conservation has been practiced. In these times, a mine which does not even claim to secure from 80 to 90% of the coal in the seam is looked upon with a feeling of scorn, if not even of sympathy. It is hard for a mining man, nowadays, to admit that he is not obtaining all the coal that can possibly be recovered. If he does not succeed in doing this it is because he labors under many difficulties.

When a man applies for a position as mine superintendent, the first question asked him is not "what per cent. of the coal can you recover," but rather "how cheap can you mine it," or "how quick can you get it out." Here is a clear case where pure economics and modern business methods do not coincide and I admit that the discrepancy is beyond my powers to point out. The applicant for the position will say "I will carry out your orders" —he has a good reason, he probably needs the job.

The president of the company, as the agent of the directors, must make a showing, the directors must declare dividends, while the stockholders will tell you that they "haven't got their money in this thing for fun." They are firm believers in conservation if it doesn't cost anything.

Coming back to the applicant who now has his job as superintendent. We find that a time will come when he is informed that the market is up and he must get out all the coal he can while the good prospects last. He is sorely tempted and usually falls. A convenient pillar can stand another slab from its side, a room can be driven just a little farther into the barrier, and room necks can be pulled just a little closer together.

The pit-boss, or the engineer, may protest—once—that the pillars are too little, that there is likelihood of a squeeze, or that they are too small to recover, but this superintendent hopes that this venture may prove better than his judgment or may justify his action with the thought that it is a large mine and the chances are that he will be dead and gone when those pillars are drawn and will let the other fellow do the worrying.

In this recital there has not been put forth an exaggerated instance, in fact it is quite common and there are many here who, I am sure, have had similar cases pass before their observation. On the other hand, I have known cases where mine foremen, inspired either by instinct or principle, have removed pillar stumps at a cost of twice the value of the coal they contained. They thus carried out the spirit of conservation, but the stockholders paid the bill. Will anyone say that the mine foreman was justified in recovering these stumps, involving as it did a possible loss of life and a certain loss of money?

The State's Geology

The general geology of this state has been thoroughly prepared through the efforts of the State Geologist, to whom great credit is due for much work accomplished with limited means. In the more important mining centers the detail

geology has been worked out complete, so that the mining man has no excuse in not being thoroughly familiar with this important part of his calling.

From these reports we find that many localities have more than one seam of workable thickness, in fact some have several. These strata are at various intervals apart and of different thicknesses. The conservationist will promptly affirm that the upper measures should be worked first in order not to disturb those lower down.

Stern necessity, on the other hand, demands that the bed furnishing the best quality of fuel, or the one that is most cheaply mined should be the first exploited. This rule is not invariable, but it is common practice, and considerable loss of coal in the ground can be charged to this fact.

However, it cannot be assumed that by mining a lower seam first it means complete destruction of those above. This is governed largely by the thickness of the lower measure, the manner in which it is worked and the interval between the two.

I have in mind a case where a 9-ft. bed was completely extracted and a seam 120 ft. above it was later opened and successfully worked, at an increased expense, it is true, but it still proving such a possibility.

Still another instance can be cited, which may be of interest here. After a 7-ft. seam of superior quality of coal was opened up, it was found that another, 4 ft. thick, of inferior quality, existed about 40 ft. above. With a spirit of conservation, reinforced by a desire to prolong the life of the field, the upper seam was opened, developed with rooms and pillars, and the latter finally drawn.

The development of the lower, or 7-ft., bed was then pushed forward in the usual manner with pillars which were considered of ample size. No difficulty was experienced until it was attempted to draw these supports. Although there was an interval of 40 ft. of solid rock between the two seams, the roof had no stability and seemed to be simply floating on the pillars; any attempt to remove them resulted in such a bad condition of an otherwise good roof that it soon became too dangerous, if not too expensive, to remove this coal. This illustrates that mining the upper seam first is not always the wisest course.

What Is a Workable Seam?

In addition to what are now considered workable seams there are many others, and the question arises what is a workable measure? In our state, where nearly all the coal is shipped into the competitive markets, coal must be mined cheaply and be of good quality. To mine a seam 30 in. or less in thickness in West Virginia there must be some peculiar local conditions, either the coal is of exceptional character or quality or its market local.

If all coal seams less than 30 in. deep are to be abandoned it would represent a very large percentage of the total coal in West Virginia. But the fact that these are neglected now will not preclude their extraction at a future time. Present operations may damage them to a certain extent, but by some additional expense nearly all the coal can be recovered. We trust that the future generations may have the necessary means for this extra expense.

West Virginia has a large variety of mineral fuel, in fact every kind of bituminous coal being found in merchantable quantities within her borders. The time is past when any solid mineral of a heat-producing nature may be termed coal. It was Marco Polo, who, when returning from his travels in China in the Thirteenth Century, gave the first definition of coal, "A stone that was black and gave forth much heat."

The fuel industry of today requires a much broader definition than this and the character of a coal has more to do with its marketability than does its quality. It fact we might say that it fixes relative prices. Without going into details, it will suffice to say that gas coal, coking coal, smokeless coal, and even splint coal in the domestic trade, each has its special application. This fact alone shows sufficient reason why some beds may be temporarily abandoned or completely ignored.

Next to its character the quality of a coal is the most important feature in its mining and is where the largest permanent losses occur. A seam that is more than 4 ft. in thickness is rarely uniform in quality, and it is common practice that if the inferior coal is either at the top or bottom of the seam, when sufficient head room can be procured, it is left in the mine and ultimately lost.

It does appear that this is a lamentable waste of fuel, but the operator must keep up his standard in the market. The B.t.u. man is constantly after him and will penalize him to such an extent that he prefers to take no chance, and as a business proposition would rather lose a cent's worth of coal in the hill than be penalized two or more cents on the coal that he mines.

A prominent authority has made the statement that coal can be considered as a fuel until the contained impurities exceed 40 per cent. Yet it is my opinion that if any operator in West Virginia attempted to market coal with more than 8 or 9 per cent. of ash he would find it extremely difficult, if not impossible.

Washing appears at first thought to be a remedy, but all coals do not respond to this treatment and, furthermore, as a fuel proposition this process really introduces more impurities than it removes.

It is a difficult and expensive operation to take moisture out of coal. West Virginia fuels, as a rule, have a long haul and the consumer pays the freight. After all it is not so much the impurity that the consumers object to, but the transportation charges. This is not true if the product is used locally, in the making of coke for instance, when there is no freightage whatever. In this case the moisture is not objectionable, in fact by some it is considered a distinct advantage.

No Help from the Consumer

The coal operator in his efforts toward conservation need look for neither help nor encouragement from the consumer. The latter is keen on getting what he pays for, but his knowledge of coal mining is so meager, or entirely absent, that his demands, if not unjust, are at least arbitrary.

During the last ten years the method of selling coal by analysis has been largely introduced and was hailed with delight by many consumers as a means of getting more for their money. Some of the specifications for the purchase of coal that have been prepared are simply ridiculous.

The operator was caught unawares and when the contract and specifications were handed him, with the option to take or leave it, he took it, to his sorrow, and learned that there was more to this B.t.u. business than he had reckoned on. But he is getting wise and is more cautious about selling coal on specification and also is not so free to say that his coal is the best in the country, especially in the hearing of a prospective purchaser. Much could be said about the various specifications that have been used, but that is a subject in itself.

I wish it understood that I am not opposed to a method of selling coal on a specification basis, but everything has its limitations, and in my opinion the methods so far suggested have not yet been perfected nor standardized to such an extent as to make them practical.

If there is any virtue in conservation, it must be plain to everyone that the specifications under which coal is sold must be so elastic that any coal, irrespective of its impurities, can c mpete in the market, based on its merits, of course. It might be said, too, that the United States government has been one of the principal offenders in this line. Only a few years ago it put out specifications that absolutely barred, irrespective of quality, 80% of the West Virginia coals. It probably had excellent reasons for doing this, but any idea of conservation was evidently absent.

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Future Advancement Will Be in Consumption

Probably the greatest advancement in conservation of fuel will occur in the methods of consumption. Take, for example, the transportation of coal, which

is the largest item of freight throughout the country. The locomotive is an extremely wasteful piece of machinery. Probably the average thermal efficiency of these engines now in use does not exceed 6%.

This means that the largest single method of consumption of fuel in the land is wasting 94% of the heat available. Yet we admit that wonderful progress has been made in locomotive construction in past years and considering our present knowledge of thermo-dynamics, much credit is due those who have accomplished even these meager results. But the fact still remains that our ignorance of this science holds out the possibilities of a tremendous saving in our coal resources.

In stationary engines advancement has been more rapid. From the simple reciprocating type to the compound condensing, the turbine condensing in large units, and finally to the gas engine with producer gas, thermal efficiency has been brought up from a very low figure to 25 to 27 per cent. Even the best that can be done is now far short of what appears good practice in theory.

The producer-gas engine method of power generation, while the most promising from a thermal-efficiency standpoint, has the further advantage of saving tar and ammonia as byproducts which is some cases represents 75% of the value of the coal at the mine. It is probable that this means will, in the near future, be largely used where power is produced at or near the source of fuel supply and distributed by electric current.

It has already been mentioned that transportation is by far the largest item in the cost of fuel to the consumer. Anything that will eliminate transportation will be a big factor, not only in the reduction of the cost of coal, but also in its conservation. At a previous meeting of our Institute, a power-plant expert pointed out the ideal economic condition with our present knowledge of power, which consisted of power plants scattered over the coal-producing area of the United States at intervals of 100 to 150 miles, all connected, and extending the distribution of current beyond the coal fields for a distance of one or two hundred miles.

This arrangement, it was argued, while representing an enormous outlay of money, would furnish power at a uniform price over the entire area and eliminate almost entirely the present transportation charges on coal used for power production, which would mean an immense saving. There is, of course, a large amount of coal which must be transported, steel mills must have gas coal, blast furnaces must have coke, ocean vessels must have fuel, etc.

Wasteful Coke Ovens

The bee-hive oven has been held up as a striking example of the waste of resources, and this we must frankly admit. But the byproduct method of coke manufacture is making great strides and it is possible the present year will show that 25% of all coke made was produced in byproduct ovens. Furthermore, there never was a time when more projects were on foot for additional equipment of this type. It is safe to predict that in a very few years this criticism will be largely removed, if not entirely eliminated.

In this brief and rather disconnected paper on conservation it has not been the aim to excuse the miner from the losses of resources that are chargeable to him, but rather to point out that in this broad question a unity of interests must exist ere much can be accomplished. To attain satisfactory results there must be a cooperation of all consumers from the humblest owner of a kitchen stove to the United States government.

The coal-mining industry admits its unperfected systems of mining and the losses caused by unfavorable conditions, but it stands ready to help the cause of conservation. We must protest, even if but mildly, that if coal is lost in this state, the blame therefor must not be laid solely at the door of the mine operator.

Is the Mines Bureau Worth While?

By William H. and Sim Reynolds

The Bureau of Mines has been subjected to a vigorous criticism during its brief existence, which Mr. Reynolds believes is unjustified and decidedly harmful to the department. He is particularly bitter at one journal for ridiculing the work of the Bureau through the publication of a humorous account of its researches.

Note—Abstract of a paper read before the W. Va. Coal M. Inst., at Parkersburg.

During the last few years a question has arisen among mining men of the United States, which is of vital interest to every official, employer and employee engaged in the mining of coal. Particularly is this true of those in the bituminous fields. This question concerns the United States Bureau of Mines. When the federal authorities instituted the Mine Bureau, they made what was then and still is, an inadequate appropriation for its best interests; and this, after the need of such an institution had been thoroughly demonstrated, and its great usefulness proven by other mining countries. Our government but followed the initiative set by older and even more conservative countries, rather than, as many of the Bureau's opponents have said, a hit or miss policy of its own.

Unjustified Attacks on the Bureau

The wisdom of this action has not until recently been generally questioned. But before taking up the matter as it appears to us of the Bureau, I may mention the point whereon this criticism hinges, as I have gathered it from a perusal of recent published articles in our most influential journals, and from personal conversations with mining men in various states. The idea seems to prevail that the Bureau has acted, and is still acting in a way derogatory to their official dignity and standing among the miners. Why any mine official or mine inspector should feel so is beyond my understanding. Personally I can see nothing whatever to justify such an attitude, which was in some instances evident even before the creation of the Federal Mine Bureau.

But I am stating what I believe to be strict truth when I assert the foregoing as the chief cause of the opposition. That this impression is unjustified is obvious to the most casual observer if he look at the subject from an impartial viewpoint. From its first inception, one of the chief aims of the Bureau has been to work absolutely in harmony, rather than antagonistic to, any other department of mining or any individual effort on the part of the larger companies made along similar lines. To do otherwise would be suicidal. The Bureau's purpose is to increase the knowledge that others engaged in the industry may have, demonstrate points which mine inspectors and state departments have neither the time nor the funds to prove, and to devise the best way to avoid and control mine accidents. This is the purpose for which the Federal Mine Bureau was primarily created.

The rescue work of the department and the demonstration of first-aid principles is also a prime element of the Bureau's work. But as Messrs Holmes, Paul, Rice and other gentlemen at the head of the bureau have themselves pointed out, this latter phase of their work should not be construed as many miners and officials have construed it, for the rescue of entombed men, or the stoppage of mine fires, as this is with the Bureau, a secondary affair.

A recently published article took

ception to the work of the Bureau through the medium of an imaginary Irish character named in the near-humorous story as one Hogan. To another by the name of Reilly, this Hogan gives his views on the inefficiency of the Bureau in general, and the hopelessness of expecting its leading men to teach those engaged in mining, anything they do not already know.

For a man here and there to vent his spleen on the United States Bureau of Mines, or any other reform movement is quite to be expected, and may be dismissed as merely the outpouring of a disgruntled mind. But when one of our leading mining journals prints the same things on pages which enter many a good mining man's home, and when, by the medium of a semi-humorous story in Irish brogue, a national institution is held up to a people's ridicule, it is about time both sides to the question were aired.

Either the United States Bureau of Mines is teaching the mining men of this country what they need to know and thereby justifying its creation, or it is deficient in its work and should be discontinued. Certain it is that the Bureau cannot long go on, let alone do efficient work, under such a fire of criticism. With the very men for whose benefit the department was created, turned against it through the publication of articles ridiculing its usefulness, a national attitude of an antagonistic nature is inevitably being formed. But if the Bureau deserve this criticism, then I for one wish the press success in its effort to crush it. There are enough and to spare of governmental appropriations being made for offices for which there is no definite need.

If, as Messrs. Hogan and Reilly would have us believe in November *Mines and Minerals,* we not only know more than the painstaking men of the Bureau can ever tell us, but have already known it as far back as the days of "*The Minin' Hu-r-r-ld*" and the "*Coll'ry Ingineer,*" then there is no need of even the insufficient appropriation made by the National treasury. But, if on the contrary the efforts of the Bureau are teaching us what we should know, and exhibiting by actual explosions and other phenomena things that we should, but previous to the advent of the Bureau never had the chance to see, then such an attitude taken by some of our journals and a number of mining men, is a grave and unwarranted injustice, and should be stifled at once and for all.

A Plea for a Square Deal

As to the merits or demerits of either side of the case this paper does not pretend to judge. We hold no brief for the Bureau of Mines any more than we do for the journals or any of the gentlemen who would belittle the Bureau's work. This paper is merely our own personal expression and belief and an entirely unsolicited one at that. It was conceived for the purpose of endeavoring to secure for the Bureau an impartial attitude on the part of the mining fraternity and the granting of fair play and a square deal. Our plea is that your judgment of the Bureau and its work be withheld at least until the Department positively prove itself guilty of the incompetence suggested against it. And that is a question which can be answered intelligently only by the nonprejudiced mining men whose sympathies are neither for nor against the Bureau.

If the Government has made a mistake in instituting this department it is certainly not alone in its error. Before the matter was even broached in our legislative halls similar institutions were organized and at work along the same lines of research in several European countries, with what eminent success you are all familiar. Shall we accede, therefore, in the indirect suggestion made in the published articles referred to that the men at the head of the English, French, German and other foreign mine bureaus are so very much superior to our own experts as to make the installation and continuance of such a body over there a matter of good policy, and in this equally important and hazardous coal country a matter of foolish political trickery?

Personally we think otherwise. In our opinion the Federal Bureau of Mines has come to stay and while we must admit that it has among its personnel some who are not the most practical in the world, yet is it reasonable to expect anything else considering the brief time the Bureau has been in existence and the meager salaries paid to the men employed in it? Yet, this single exception aside, it is equally obvious to all of us that the men at the head of this department, men such as Dr. Holmes, Rice, Paul and Wilson, and others of like ability, are without peers in their line of work. Have they not by actual proof at Bruceton and the Arsenal Grounds at Pittsburgh convinced thousands of miners and officials that coal dust *will* explode without the help of marsh gas or any other aid except the mere ignition of its own components? And were *any* of us *sure* of that until the Bureau proved it by actual experience at Pittsburgh? The only men who might have known positively, through having experienced it, were not in position to tell, for a coal dust explosion certainly believes in the adage that "Dead men tell no tales."

"Hogan" and "Reilly" Again

Mr. Hogan, in the semi-humorous article referred to, says the Bureau of Mines makes him tired. "Here they ar-r-re spindin' a lot of money an' makin' a gr-r-ate hullabuloo out neaer Pittsburgh. ixplodin' coal dusht in an ixpirimintel mine, an' provin' to the minin' men pwhat we all av us alriddy knowed, an' pwhat *The Minin' Hur-r-ld* an' *The Coll'ry Ingineer* printed twenty or tharty year-r-s ago . . . ."

Certainly my friends, the type of mining man exemplified in Mr. Hogan *may* have known that coal dust needed watching, but "we all" did not know it, as Mr. Hogan advances, or at least would not concede it. There were thousands of miners in one of the most dangerous coal-dust fields in the world, that through which cuts the Youghiogheny and Monongahela River, who despite the printed word of *Colliery Engineer* or *Mining Herald* did not believe until enough of them saw with their own eyes. I wish to say in all earnestness that if the United States Bureau of Mines had nothing else than this single fact to its credit our Government had done well in creating it and appropriating money to carry on its work. And does it occur to any of us that this one great vital proof relative to one of the destructive elements of underground work is all that may yet be learned?

Despite the drawback of a governmental parsimony, and an unreasoning prejudice in certain quarters, the Bureau of Mines is doing all that can be expected of it. It has made mistakes and it may continue to do so. Their public demonstrations of what they have found out and proved again and again, have done more to eliminate explosions than was possible by any other agency, including our esteemed journals, and they have been in the work only a short while. For the mining man is prone to doubt a mere printed assertion when it comes in conflict with opinions he has been trained from boyhood to look upon as infallible, but he cannot doubt what he sees with his own eyes. It was simply a case before the Bureau's time of not being certain about it. The Bureau has taken away the doubt, not alone regarding the explosiveness of dust, but in many other things quite as vital to our welfare in a way.

Some Things the Bureau Has Accomplished

And it has always striven to work in harmony with state departments and the men in charge of mines. Such prejudice and animosity as have been evinced have come all from one side, and that side is not theirs. Also it has striven to do well what it has done. Some of its critics accuse it of lethargy, of failure to accomplish as much as it should in the way of quantity as well as quality. They fail to realize that the kind of research the Bureau is making cannot be hurried as one of you hurries things up when you set out some morning to break the record in output of coal. They do not apparently take into consideration that in working out to a practical, positive conclusion some disputed point or theory, these men at Pittsburgh and elsewhere

must wade through a great many wrong things to reach the right one.

That the results of its work may be easily miscalculated is obvious. The benefits which are accruing are of that kind which cannot be set forth in figures. The very aim for which the Bureau was created, is to decrease or obliterate those familiar, gruesome, lengthy columns of mortality. And the better these men do their work, the more they teach the men they are paid to teach the less there will be to set forth. The results of the work of the Bureau is showing in the decrease of great disasters and the lesser accidents, and in the more careful use of explosives.

The unbiased among us are beginning to realize that there is a power for good at work somewhere, quietly, silently but potently, making its presence felt in every coal field in the United States. Without ostentation regarding its work—Messrs. Hogan and Reilly, notwithstanding—there are strong influences at work disseminating knowledge which is giving to the mining village more happy children and unstarved women, and fewer trench graves containing their hundreds of mining dead on the hillside beyond the mine. And not one of the least of these influences which are making the mining of coal safer, saner and less tragic than it used to be in the days of *"The Minin' Hur-r-rld* an' *The Col-lry Ingineer"* is the United States Bureau of Mines.

A New Storage Battery Haulage Locomotive

The General Electric Co. is building for use in the construction of the New York Aqueduct, several storage-battery locomotives of the kind shown in the accompanying illustration. The application of these machines is novel in that they represent the pioneer storage-battery type built for tunnel or mine work in this country.

Industrial or tunnel locomotives impelled by storage battery are designed especially for short hauls at moderate speeds, where it is either impossible or undesirable to install a trolley system.

Construction of the Machine

The frame of the locomotive in question consists of steel channel sides and plate ends carefully fitted together at the joints and held rigidly in place by bolts and angles. The cast-steel roller-bearing journal boxes of special design, are supported by two spiral springs between cast-steel pedestal jaws or guides bolted to the lower flange of the side-frame channels.

The wheels are pressed on and securely keyed to the axles which are of a special grade of steel, case-hardened at the journals so that there is practically no wear either upon them or the bearings.

The motors are of the familiar automobile type, designed especially to operate from batteries, and have characteristics that effect the maximum possible economy in the use of current. They have high efficiency, large overload capacity, and operate with practically sparkless commutation. These machines are compactly designed, yet readily accessible for inspection, and the armature shaft is provided with ball bearings. They are dust and moisture proof and are mounted in suspension cradles in accordance with ordinary locomotive practice.

Gear Reduction and Battery Arrangement

As slow service is ordinarily required of these machines, the employment of double-gear reduction from armature shaft to axle, permits of high tractive effort without rheostatic losses and at small current input.

New Storage-battery Locomotive

The specially designed, rigidly constructed, 44-cell batteries having a 5-hr. discharge capacity are provided with plates made expressly for them having high ampere-hour efficiency. The cells, grouped in four or more trays, each provided with rollers to facilitate removal, are mounted on top of the locomotive frame in a sheet-iron case with wooden base and cover.

There can be no question as to the efficacy of the trolley system of haulage in most cases, but where local conditions forbid its installation, the storage-battery type of locomotive has, in practice, proved to be an excellent substitute.

In a rope system all sheaves, regardless of their position, should be of the same size, so that the rope will bend at the same angle at all times which adds considerably to its life. Haulage ropes should receive a weekly coating of preservative to protect them from injuries due to dirt and water. Rollers should be kept free and not be over 20 ft. apart.

Explosion Proof Motors

"An Investigation of Explosion-Proof Motors," is the title of Bulletin No. 46, which has just been issued by U. S. Bureau of Mines. The author is H. H. Clark, who has charge of the electrical investigations of the Bureau of Mines.

The term "explosion-proof," as applied by the Bureau of Mines to an electric motor, refers to a motor inclosed by a casing so constructed that an explosion of a mixture of mine gas (methane) and air within the casing will not ignite a mixture of the same gas surrounding the motor.

There are two classes of motors so constructed. First, a totally inclosed class built strong enough to withstand high internal pressures and so designed that the efficiency of all inclosing covers can be satisfactorily maintained. Second, a class provided with relief openings or valves designed to relieve the pressure of an explosion within the motor casing and to cool any products of combustion discharged through the valves.

A satisfactory motor of the first class is much more expensive to build than an equally safe motor of the second class. For this reason, attempts to make motors explosion-proof have been confined chiefly to those of the second class.

The investigation described in this bulletin was undertaken by the Bureau of Mines as one of several investigations having for their purpose the ascertaining of methods for lessening the risks attending the use of electricity in mining.

The bureau began this investigation by sending a circular letter to manufacturers of electric motors for mine service, stating that it proposed to make tests of electric motors designed for operation in the presence of methane in order to determine their suitability for such service. This letter was sent to all manufacturers whom the bureau believed would be interested in the proposed tests. Five motors were submitted for the trials.

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CIRCULATION STATEMENT

Of this issue of Coal Age, we will print 11,000 copies. No copies will be sent free regularly. There will be no back numbers. The figures shown here each week represent live, net circulation.

This journal is interested solely in matters relating to the fuel industries, and is designed to be a medium for the free interchange of ideas, the detailed description of coal-mining practice, and the expression of independent thought calculated to benefit both operator and miner.

Contents

COAL AGE

The Supreme Court Decision and Anthracite Coal

The decision handed down this week by the Supreme Court of the United States on the anthracite-coal-roads case is attracting the attention which its importance deserves. As to the ultimate effect of the points covered by the decision, we think it too early to express an opinion.

There are, however, some pertinent observations which stand out rather prominently. The public is interested in the cost of coal to the final consumer. Well-informed business men, engineers and operators know beyond peradventure that, speaking broadly, the cost of mining anthracite cannot be reduced, but rather, on account of the high standard of wages, and the cost of everything entering into operating expenses, it is likely to increase.

The only relief, therefore, that can be hoped for in the matter of cost of coal to the consumer is a reduction in the rates on freight. It is well known that the rate per ton-mile for transporting hard coal from the mines to market greatly exceeds that on bituminous coal or other similar bulk freight, anywhere in the land.

The arguments put forth by the transportation companies in support of the exorbitant freight rates are somewhat similar to those formerly advanced by the anthracite mining companies in support of the two hundred per cent. profit on powder sold to the miners.

We believe the recent decision will serve to clear the decks for the solution of this problem; namely, the establishment of equitable charges to the public for hauling its fuel.

Since the allied anthracite coal roads succeeded in choking off possible competition, as set forth by the Supreme Court, and there is no likelihood of competitive conditions being established, it remains for the Interstate Commerce Commission to intervene and establish such fair and equitable rates as the service warrants. We think this is the hope of the public, and efforts in this direction are likely to result successfully.

The Increasing Popularity of Concrete

Perhaps no building material known has been received with as much favor throughout mining districts generally as concrete. Finding its first application in shaft linings and drift mouths, where the principles of the arch could be taken advantage of, its use has rapidly spread until it is now employed for building such structures as tipples, breakers, washeries, power houses, substations, stables, and so on. Its employment for these latter purposes has been rendered possible largely, if not entirely, by the introduction of iron bars, rods, or wire-mesh reinforcements.

Although the introduction of reinforcement in concrete is usually considered as a modern invention, as a matter of fact, it is really of quite ancient origin. In large structures, straight concrete acts almost exactly the same as rubble masonry and closely analogous to buildings composed of heavy or dimension stone.

The practice of tieing together the heavy stones of a structure with rods or bars of iron is almost as old as any knowledge which we possess of the metal. One of the kings of ancient Egypt describes the Imperial Tomb as being composed of great stones securely tied together with bands of "man-metal." No metal whatever has been found in this tomb, so it is generally believed that "man-metal" signified what we today know as wrought iron, and which, due to its high corrosive propensities, has long since rusted out and disappeared.

It has remained for the modern engineer, however, to develop and put into practice the laws of scientific reinforcement. The basic principles underlying this application of steel or iron are few and can be easily stated.

The compressive strength of concrete is about ten times its tensile strength. Volume for volume, steel costs approximately 50 times as much as concrete; but, in tension, it will carry about 300 times the load. For use under compression, concrete will carry a given load for

approximately six-tenths the cost of steel, but in tension the cost of concrete would be six times as much as steel.

The two most bulky ingredients of concrete, sand and crushed rock, may be secured in almost any locality at a merely nominal cost, and the reinforcement, if properly placed and embedded, is entirely sealed in and, therefore, free from corrosion. Thus it can be readily understood why this material is finding such universal favor and making such rapid strides in practically all permanent construction.

It must not be concluded from the above, however, that concrete may be considered as an "Eldorado" or "promised land" in the field of building construction. Its utility, economy, and durability depend quite as much upon the care and intelligence with which it is placed as upon its component parts. Work poorly or improperly executed is unsatisfactory and expensive, regardless of the materials employed.

In selecting any material for construction, the matter of cost is one of the first considerations. To the average individual, this will mean first cost, as he usually neglects the important factors of interest, depreciation, insurance and taxes. Where concrete or reinforced concrete is employed, provided the building is properly designed and constructed, the items of depreciation and insurance may be practically disregarded.

The first cost of this class of construction is contingent upon so many varying conditions that only approximate estimates can be quoted. Under the most favorable circumstances, when laid in large masses it may cost as low as $4 per cu.yd. But on the other hand, when laid under adverse conditions, in thin walls, where the cost of the forms is relatively high, where only unskilled labor is available, and the price of material is excessive, the cost may run up to $20 per cu.yd., or even higher.

In considering the relative advantages of various materials, as pointed out above, the ultimate cost must be kept definitely in mind. That substance which, when once properly installed, is the most time resisting and permanent, will be found, in many cases, to be the most satisfactory and cheapest, even though its first cost may appear to be excessively high.

National Housing Conference

It is interesting to notice that the Pennsylvania Housing Conference, which met shortly before the National body in the early part of this month, is taking some interest in the housing of miners. The open and avowed purpose of this organization is to obtain ameliorative legislation for the bad housing conditions throughout the state.

To get the information needed, they induced Father Curran, the well known priest in Wilkes-Barre, and R. Dawson Hall, to deliver addresses. It is an assurance of the integrity of the conference that both papers were kindly received, though neither of the authors had much to deplore in the housing of coal miners. Such audiences too often anticipate a surfeit of indignation and sorrow, and are displeased when the opportunities for wholesale condemnation are not furnished them.

It has been a time-honored trick of the muckraker and social agitator to show interiors by photographs or descriptions in which the plaster is broken and the furniture disreputable. They overlook, or desire the public to forget, that the plaster was almost certainly broken by the violence or improper acts of the tenant and that the furniture and its condition has absolutely no bearing on the housing question.

In fact, as was said at the meeting, the condition of the tenement is "the outward and visible sign of the inward and spiritual grace" of the tenant rather than an exhibit of the moral sense of the landlord. Such illustrations of the battered walls of a badly used bedroom and the broken furniture of an undesirable tenant, have urged sympathetic philanthropists, male and female, to construct desirable homes for respectable tenants, but these good works do not meet the issue at all. The charitable lessor employs agents who scan suspiciously every would-be renter and make secret rulings which would not bear the scrutiny of the public.

The average settlement worker cannot realize that the only solution for the disreputable tenant is to turn him into the rain and snow, to permit him to continue in the chamber he has defiled, to move him to quarters just as foul or to keep him in jail. However, there is no other way to handle him.

The coal operator will not, if he can help it, admit such men to his mines, and the worthless, useless members of society give the coal diggings a wide berth. That is why such harrowing scenes cannot readily be found in any of our mining regions.

Moreover the operator, in his quest for men, has continually made his houses more desirable in the endeavor to attract the best type of employees, and some have even gone further than business principles, unbacked by moral impulses, would countenance.

Hence the worst of mining towns show reasonable samples of housing, and the only complaint to be made with justice is that sanitation is not of the best. The reason for this defect is to be found in the universal lack of interest in the subject, especially in the more healthy mine villages of the Northern states.

A town with a perfect system of sanitation, as far as underdrainage and the disposal of wash water is concerned, would not secure any more men than a town not so equipped. It is this alone which retards development in sanitation, but after all this the subject is rather one to be discussed in a sanitation than a housing conference, and could only be handled satisfactorily by the departments of health.

We think that a crowning need of our time is some instruction in the public schools and by subsidized lectures on "how to use a good house." Until the use of an uptodate tenement is well understood by the rank and file of mining employees, it is not to be expected that any great advance will be made. A careless tenant will make a model residence more menacing to health than one in which all the sanitary provisions are placed outside the house. Something has been done in England for many years to teach hygienic living. Lecturers visit all the schools every year and teach the principles of healthy housekeeping to adult members of every village, the addresses being extremely practical and accompanied by ocular demonstrations. It would be well if something similar were done in the schoolhouses of our mining and other towns.

Much can be accomplished in the way of attaining practical results if the management and under officials would give this matter the attention it deserves.

Discussion by Readers

Comment, Criticism and Debate upon Previous Articles, and Letters from Practical Men

Attributes of a Mine Foreman

Referring to the article on this subject, by a Pennsylvania reader, COAL AGE, Nov. 16, p. 671, it seems to me while the ability to hire men properly is an important attribute of every mine foreman, it is not the chief essential element that goes to make a successful foreman. My experience in coal mines teaches me that the most successful mine foreman is the man who has a thorough practical knowledge of mining in all its various branches, relating to shaft, slope or drift mines.

From the company's standpoint, the most successful foreman is the man who can get the work done in the best way, the quickest time and with the least expense, having, of course, due regard to the durability of the work and the safety of the men employed. In order to accomplish these results, it is necessary that the foreman in charge of work must be firm; he must insist that his instruction be carried out fully, being satisfied that his way is the best, as far as his knowledge goes. It is not necessary that a foreman be dogmatic or severe with his men; he will gain more by being civil, plain and kindly spoken.

A PHRENOLOGICAL SUGGESTION

In the article to which I have referred, the writer does not explain how he would "size up" a man who applies for work. In my judgment, a man must have a natural ability to read men's characters in their faces, and a long experience in hiring men and handling labor, before he is fully qualified to reach safe conclusions in regard to the character of an applicant for work. Comparatively few mine foremen have this natural ability to read men's characters.

Some have made a study of the science of phrenology, and have applied this knowledge successfully in discerning what is the true character of a man and his ability to perform good work. I believe this knowledge will greatly assist the mine foreman in his choice of workmen. It is true, however, that, while a man's predominating temperament can generally be read in his face by one who understands human nature, it would not enable all foremen to discriminate accurately between the men applying to him for work in the mine. Even if this were possible, a mine foreman is often compelled, under the force of circumstances, to hire many undesirable men whom he knows will make poor miners. He must do this in order to maintain his daily output of coal when labor is scarce. His knowledge of the character of such labor, however, will enable him to place them where they will not endanger their own lives or those of others.

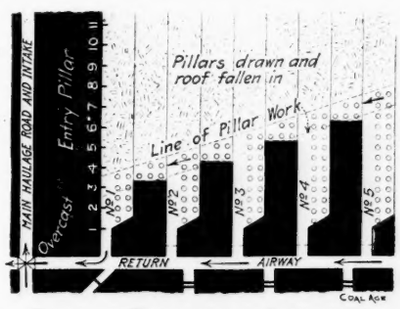
I want to suggest that, inasmuch as the state mining law holds the mine foreman responsible for the lives of the men in his charge, it would seem only reasonable that, as far as practicable, the state should provide means for educating mine foremen along lines that will enable them to judge better of the character of the men they employ. This could be, perhaps, best accomplished by night schools or lectures during six or eight weeks in the year, in all mining centers. I would suggest that phrenology would be an interesting and helpful subject to be taught.

G. T. M.

Republic, Ala.

Drawing Room Pillars

There are two general methods of drawing back pillars, in a mine, after the rooms have been driven up to the limit. In any case, the method to be adopted will depend on the conditions, as determined by the amount of roof pressure and the strength of the roof strata. In some cases, the pillarwork can follow up the roomwork, on the advancing system. In other cases, the condition of the roof is such that it would not be safe to under-



PLAN OF PILLARWORK, ADVANCING SYSTEM

take to draw back the pillars until all the rooms on that entry had been driven up, and it is intended to abandon that section of the mine. In that case, the work of drawing back the pillars must follow the retreating system; or, in other words, the pillarwork must start at the inby end or the last room on the entry, and proceed in regular order toward the main entry.

Whatever system of drawing back the pillars is adopted, there are certain points that are essential for its success. In all cases, the pillarwork should be kept in a uniform straight line so as to avoid the undue weighting of any of the pillars, which would result if one or more of the pillars were allowed to fall behind. In general, it is not necessary that the line of pillarwork shall parallel the entry. When there are slips in the roof that have a general direction, or there are distinct cleavages in the coal, it may be advantageous to have the line of pillarwork cross these slips or cleavages at an angle so as to avoid sudden and heavy roof falls that would be apt to occur if the line of pillarwork parallelled the direction of the slips or cleavages. By maintaining a uniform straight line of pillarwork, a larger percentage of lump coal will be produced, because the pillars will be less crushed by the steadily advancing weight as the overlying strata settle down on the waste.

The accompanying figure shows a small section of pillarwork, on the advancing system. The rooms here have been driven up to the limit, and the work of drawing back the pillars has progressed so that the pillar separating the first two rooms on the entry is almost finished. In this case, the rooms have been driven 24 ft. wide with 24-ft. pillars between them. The roomnecks are 8 ft. wide and driven up 7 or 8 yd. before being widened to the full width of the room. This provides good solid room stumps for the protection of the entries. These stumps are allowed to remain until the entry pillars are drawn back on abandoning the section.

An important point that I have found of great advantage is to mark off, say, 15-ft. lengths along the pillar, in each room. These distances can be marked 1, 2, 3, 4, etc., with chalk or white lead, as shown in room No. 1, in the figure. This system will not only assist in keeping the line of pillarwork uniform, in the several rooms; but will prove a great help to the mine foreman, also, in measuring up the work; and, if observed, will guard against large roof falls, which are always dangerous and should be avoided by drawing all standing timbers, as the line of pillarwork recedes. The success of pillar work depends on a regular and uniform roof settlement.

GEO. STOCKDALE.

Mount Braddock, Penn.

Should Mine Fans Be Built Reversible?

Letter No. 29—COAL AGE could hardly have chosen a subject of greater interest and importance to the mining fraternity than the one that has recently been under discussion.

In my opinion, all mine fans should be built reversible, especially where the mine is dry and dusty and gives off explosive gas, blackdamp and powder smoke; or where there is a difference of more than 60 ft. in elevation between the main inlet and outlet of the mine.

It is an unpleasant duty to recall preventable mine accidents, and we are often wearied with the numerous speculations on mine air and other conditions affecting the health, life and property in mining coal. It is important, however, to consider carefully all those conditions and causes that are thought to produce the largest loss of life in mines. Wherever proper attention has been given to adjusting, as far as possible, the temperature and humidity of the mine air, the effect has been to reduce the liability to fires and explosions in the mine.

The inquiries into the causes of mine accidents, by mining boards and bureaus, have done much to relieve those in actual charge of mines of their responsibilities, in this regard. In many cases, these inquiries have resulted in the adoption of methods that have gone far toward reducing liability to accident. I believe this is true in regard to reversible fans. The science of mining has made rapid strides in the past decade, and there is much to be carefully studied.

I believe that mine fans should be built reversible; and if this means is properly used, as conditions may require, mine fires and explosions can be minimized if not eliminated and the loss of life greatly reduced. This statement may seem to many to be overdrawn, but when we consider carefully the effect produced in a mine by an air current that has not been adjusted to the conditions of the mine with respect to temperature and humidity, we will realize more clearly the necessity of providing for such an adjustment of the intake current. I believe that this adjustment of the air can only be satisfactorily accomplished, in all seasons of the year, when the fan is made reversible.

It will not be necessary to enumerate or rehearse the various conditions with respect to the freezing of moisture in the crevices of the rock, and the disintegration of the rock strata due to changes in the mine with respect to the temperature and humidity of the air. It will not be out of place, however, to refer here to the fact to which attention has been previously called, that unadjusted mine air travels low in the mine entries during the coldest season of the year, drying out the coal dust, timber, brattice boards and cloth and, in fact, everything in the mine. When the air is properly tempered, that is to say, when the intake current is adjusted to the temperature and humidity of the mine the air current, in summer as in winter, will find easy access to the high points in the mine and more completely remove the explosive gas over the falls; and such tempered air will keep all combustible material in a moist condition.

The point which I desire to impress and which, perhaps, I have not made clear, is that where a nonreversible fan is exhausting the air from the mine it is not possible to adjust the mine air with respect to temperature and humidity as readily and completely as when the fan can be reversed. This fact is proven by observation. In mines ventilated by a nonreversible exhausting fan and where the air is allowed to enter the mine unadjusted, experience teaches that excessive roof falls, gas and dust explosions and mine fires are common; and these results are less frequent where the fan is reversible and due attention is given to adjusting the intake current.

KARL F. SCHOEW,
Mine Inspector, 1st District.
Fairmont, W. Va.

Letter No. 30—I have read all the past letters discussing the reversible fan and enjoyed every letter. We have discussed the question in and out of the mine and have come to the conclusion that the reversible fan is a necessary part of the equipment of every mine, for two principal reasons:

1. In case of a fire on the intake airway or any other accident requiring the air to be reversed, this can be done quickly on the surface, if the fan is reversible.

2. A reversible fan makes it possible to change the direction of the air in winter when it is necessary to prevent the formation of ice in the airshaft.

After careful study, I believe that the interesting letters that have been written discussing this question differ only in respect to the conditions that, for the most part, have prejudiced the writers. In considering the question of whether a mine should be equipped with a reversible or a nonreversible fan, however, we should remember the large number of men who have lost their lives or been permanently crippled, and the thousands of widows and orphans that are the result not only of the mistakes and carelessness of those in charge, but also of the inferior equipment of the mine. We should consider the question from a broad standpoint and not be confined to particular conditions existing in such mines. I believe it has been proven in this discussion that there are conditions that demand that every mine be equipped with a reversible fan.

JOHN SUTTON,
West Terre Haute, Ind.

Guarding Trolley Wires in Mines

Referring to the item on this subject, COAL AGE, Dec. 7, p. 808, I would say that practical experience and observation have shown me that it is often a difficult and expensive matter to protect the trolley wires at "all exposed points, such as landing, sidings or partings, or wherever men are required to pass under the wire." The bituminous (Pennsylvania) mine law requires that the trolley wires in mines shall be so protected, or elevated 6½ ft. above the track.

The protection of the trolley wire becomes a hard proposition when the coal is low and the roof hard. The use of boards to protect the wire is not only expensive because the boards decay; but this method is dangerous, because the boards often become loose and hang down, and are liable to catch the motorman if he does not constantly watch for them, since they are on his side of the heading. Again, if, as frequently happens, the trolley pole jumps the wire, the boards guarding the wire are apt to be pulled down. The boards add an excessive weight, also, to the hanger bolts, which are frequently pulled out of the roof by the weight upon them. These troubles make the board system of guarding the trolley wire expensive and dangerous.

Even if the rock is hard, I prefer to shoot the roof and elevate the wire to the height above rail required by law. This makes a more permanent job and is cheaper and safer in the long run.

As far as practicable, the wire is carried on the opposite side of the road from that on which the rooms are turned. When it is necessary to put in a switch on the wire side of the road, an insulated cable can be used to jump the current across the track. In this case, however, the motor should be provided with two trolley poles, one on each side of the machine, the one not in use being held down by a hook fixed to the frame of the motor. It takes but a moment for the motorman to raise one pole and lower the other when necessary to do this, in passing such places.

Such an arrangement will reduce to a minimum the number of places to be guarded, and at the same time reduce the liability of persons coming in contact with the wire. Back-heading or air-course switches, on this side of the entry, can be treated in the same manner; or the trouble may be best avoided by not running the wire past such points until another crosscut is through, and the out-by crosscut is abandoned, when the trolley wire can be extended to that point. This will keep the wire within 70 or 80 ft. of the face at all times.

ARTHUR DUKES,
Mine Foreman.
Marsteller, Penn.

Reducing Ventilation at Firing Time

In a previous letter, I outlined briefly the experience that led me to believe that reducing the ventilation at the time of firing acted to prevent an explosion in a mine. I will now explain fully the results obtained in a more recent test that I have made. In August, 1906, the Western Coal & Mining Co., sank a mine (No. 15), seven miles north of Pittsburg, Kan., near the famous Devlin-Miller mine, in which so many explosions occurred and the loss of life became so great that the governor appointed a commission to investigate and report the cause.

When the Western Coal & Mining Co. was ready to produce coal at the new mine, No. 15, I was appointed fireboss and shotfirer at the mine. The Kansas law provides that the air shaft shall be located at least 300 ft. from the main shaft. In opening up this mine, the main shaft was divided into two compartments to provide a downcast and an upcast airway. The mine generated much firedamp and it was necessary to pipe the air into many of the places. In shooting this mine, I had the air shut off and experienced no trouble. When the airway was completed to the escape shaft, we made arrangements to close this connection during firing time.

The same company had now opened a new mine, No. 16, one mile from No. 15. I was appointed mine foreman of the new mine. In opening up this mine, No. 16, we put cages in both shafts in order to push the development more rapidly. I shut off the air at firing time and had no trouble. I stayed with the shotfirers while they were doing their work.

When the main-north entry cut through to the air-shaft heading, the holing was 3x3 ft. The natural ventilation passing through this opening was 6000 cu.ft. of air per minute. This furnished what I thought would be a favorable condition to prove that the air was a prime factor in producing an explosion. I ordered all miners to be careful in placing their shots. When the shots were prepared, I sent everybody out of the mine and, as we had many carpenters busy on the construction of the tipple, fan and fan drift, I had all these persons leave their places and go at least 200 ft. away from the shafts, telling them that we were going to have an explosion. After giving the engineer instructions to hoist us quickly when he received the signal, I and the two shotfirers went into the mine, lighted two shots and made our escape to the surface to watch results.

The explosion that followed shot out of the downcast shaft, throwing timbers and rock at least 300 ft. above the sheaves. At the upcast shaft, many of the workmen had left their coats hanging on the shaft timbers, and these were first drawn into the shaft and almost instantly blown back and left hanging in the sheaves. The damage in the mine was slight, owing to the limited development at that time, but much coking was done on the ribs and timbers, because of the intense heat. After this experience, I removed the hoisting equipment from the upcast shaft and placed heavy doors over that shaft to prevent any circulation of air during firing time. There has never been further trouble at that mine.

About this time the company changed the foreman at mine No. 15. The new foreman allowed the fan to run during firing time, although complaints were made by the shotfirers about the matter. Feb. 17, 1907, I received instructions from the superintendent to visit the mine, and report to him the conditions existing there. I went to the mine, made an examination of the conditions and explained to the foreman the danger present. No action, however, was taken by either the foreman or the superintendent. After making that examination I went to the homes of the shotfirers and advised them to quit; but they continued, and, three days later, lost their lives in the most terrific explosion it has ever been my lot to witness. After that explosion I received a message to at once take charge of the mine and put the same in working condition. This I did, returning afterward to mine No. 16 as foreman.

Mine No. 15 worked for the next eight months without further trouble. Steam humidifiers and water sprays were installed and water boxes were used freely to wet the roads. The dust was cleaned up regularly. But notwithstanding these precautions, the second explosion occurred Nov. 6, 1907. It was now almost impossible to secure shotfirers at that mine, although the foreman offered $8 per day. Nov. 13, 1907, I received a message from the superintendent, telling me to go to that mine and instruct two new men who had accepted positions as shotfirers. When I arrived at the mine, the men were there, and, with myself, the foreman and four other persons, went through the mine. The fan was slowed down, the humidifiers were in operation. It was with difficulty we found our way, owing to the dense fog in the entries. On measuring the air, we found 27,000 cu.ft. traveling on the north side and 34,000 cu.ft. on the south side of the mine.

I explained the danger of shooting under these conditions and pointed out the danger zone. I selected a point on the north side of the mine where the air was split, and marked that point with chalk on the roof. On the south side of the mine I did the same, marking the place with chalk and telling all present that an explosion would come from either one of those places, if the conditions were not changed. On returning to the surface, I interviewed the superintendent, giving him the same information. I marked those places on the blueprint in the superintendent's office and suggested that he stop the fan and have the air short-circuited before firing, which, however, was not done.

The shotfirers commenced firing shots about 10 a.m., Nov. 13, using great care and firing but one shot at a time. They reached the danger zone that night about 7 p.m., when one of the men refused to fire any of the shots in the two places I had pointed out. They thereupon came to the surface. The foreman insisted, however, that they return and fire those two places. Accordingly one of the shotfirers refused, resigned his place and went home. The foreman then secured another man who, with the other shotfirer, entered the mine, and going directly to the place, fired the two shots, and a terrific explosion followed.

I headed a rescue party. The hoisting equipment was destroyed, and the fan drift blown out; but having secured a block and tackle I was lowered into the mine. I found the downcast choked with broken mine cars, but rescued those two men in thirty minutes. One of them died the following morning. I refused then to have any more to do with that mine, because my advice was not followed. The wreck was cleared up, however, and the mine started to work again Nov. 30, when another explosion occurred, in which both shotfirers lost their lives. The explosion, this time, came from the opposite side of the mine, at the place I had selected on my visit, making in all three explosions in November, on the 6th, 13th and 30th. The mine inspectors claimed, through the press, that they had done all in their power to prevent those explosions and failed. I was requested to take charge of the mine again, Dec. 1, 1907, and will give the results in my next letter.

ALEXANDER MCALLISTER.

Croweburg, Kan.

Textbooks in Mining Examinations

Believing that the examination of candidates for all positions of trust in mining should be thorough and practical; and further being fully convinced that safety and economy in coal mining demand a knowledge of the principles involved in the work, but do not require the memorizing of the tables, constants and formulas used in working out the daily problems of the mines; it is the intention of COAL AGE to urge upon all mining examining boards the importance and necessity of so arranging their examinations that candidates will be permitted and expected to use the textbooks with which they are familiar, in the examination. We hope soon to bring this subject forward for discussion.

J. T. BEARD.

New York City.

Examination Questions

Selected from State Examinations, or Suggested by Correspondents

Examination Questions

(Answered by request)

Ques.—How would you, as mine manager, proceed to make an examination of the mine and its equipment with a view to securing the greatest efficiency and safety of operation?

Ans.—This is too broad a question to answer in detail. The successful mine manager must be acquainted with every requirement of the work. If his department is properly equipped, he is furnished with daily, weekly and monthly reports, showing the cost of each operation in detail. He examines these cost sheets closely to determine if any saving in expense is possible or practicable. With a full knowledge of the cost of production at hand, he proceeds to investigate, through his assistants, each department and branch of the work, to ascertain what changes, if any, can be made that will expedite the work, decrease the cost, or increase the safety of the operation. By this means a mine manager is able to increase the efficiency of his plant to the degree that he himself is intelligent and capable. The mine manager should take means to ascertain to his own satisfaction that the mine is being operated in compliance with the mining law.

Ques.—A certain seam cuts a vertical fault and the upthrow is found to be 60 ft. The seam beyond the fault dips at the rate of 4 in. per yd. What is the length of a drift rising 1½ in. per yd., that will cut the seam beyond the fault?

Ans.—The combined dip of the seam and rise of the drift is 4 + 1.5 = 5.5 in. per yd. Assuming horizontal measurements in the seam and the drift alike, the horizontal length of the drift, measured from the fault to the place where it cuts the seam, would be

$$\frac{60 \times 12}{5.5} = 130.9 \text{ yd.}$$

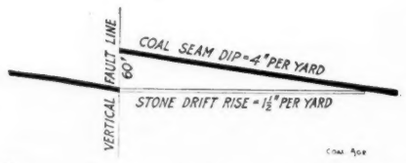


FIG. 1. SHOWING A VERTICAL UPTHROW OF SIXTY FEET

Fig. 1 shows the relative position of the fault, the seam on each side of the fault, and the stone drift driven to the rise, across the strata, to connect the seam at the fault with the seam beyond.

Ques.—If the backsight *BA* (Fig. 2), is N. 40° E., 1230 ft., and the foresight *BC* is S. 60° E., 3042 ft.; what is the length and bearing of the closing side *CA*?

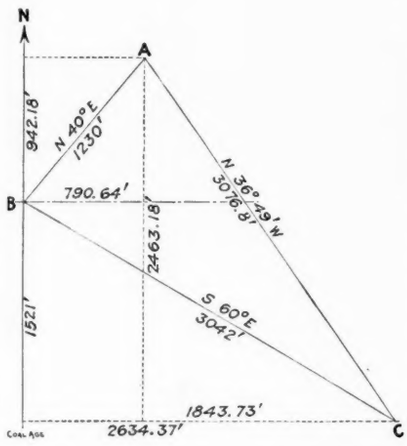


FIG. 2. PLAT OF SURVEY, SHOWING THE COÖRDINATE SYSTEM OF CALCULATING THE CLOSING COURSE

Ans.—Starting from *A*, the bearings and length of the courses, together with the latitudes and departures, are as follows:

Bearing	Distance	Latitude	Departure
S 40° W	1230	942.18 S	790.64 W
S 60° E	3042	1521.00 S	2634.37 E
		2463.18 S	1843.73 E

The total latitude or southing is, therefore, 2463.18 ft., and the total net easting 1843.73 ft. In order to close this survey, the line *CA* must, therefore, have a northing of 2463.18 ft., and a westing of 1843.73 ft.

To find the bearing of this closing course, call the angle of the bearing *a;* then,

$$\tan a = \frac{1843.73}{2463.18} = 0.7485$$

and $a = 36° 49'$. The bearing of the closing course is, therefore, N.36° 49'W.

The length of the closing course is then found as follows:

$$\frac{2463.18}{\cos 36° 49'} = \frac{2463.18}{0.80056} = 3076.8 \text{ ft.}$$

Ques.—Give the size and number of flues required in a boiler 8 ft. in diameter and 16 ft. long, in order to produce 160 hp. Also, find the grate-bar surface required. Taking the tensile strength of the steel as 60,000 lb. per sq.in., calculate the thickness of the boiler shell to withstand a pressure of 200 lb. per sq.in. Also, give the size and kind of safety valve used on such a boiler.

Ans.—Allowing 12 sq.ft. of heating surface per horsepower for this type of boiler, the total heating surface required is 160 × 12 = 1920 sq.ft. Then, ignoring the small area of heating surface at the two ends of the boiler, the heating surface per foot of length of the boiler is 1920 ÷ 16 = 120 sq.ft. The boiler being 8 ft. in diameter, the circumference of the shell is 8 × 3.1416 = 25.13 ft. Assuming that two-thirds of this circumference is exposed to the flame and hot gases, the heating surface of the shell, per foot of length, is ⅔ × 25.13 = 16.75 sq.ft. This leaves 120 — 16.75 = 103.25 sq.ft. of flue surface per foot of length. If the diameter of the flues is 5 in., the circumference of each tube is 5 × 3.1416 = 15.708 in., or, say 1.3 ft. The number of 5-in. flues or tubes required will then be 103.25 ÷ 1.3 = say 80 tubes.

Using a factor of safety of 7.5 and assuming a double-riveted, lap joint having an efficiency of 75 per cent., the required thickness of the boiler plate to carry a steam pressure of 200 lb. per sq.in. is

$$t = \frac{7.5 \times 200 \times 8 \times 12}{0.75 \times 2 \times 60{,}000} = 1.6, \textit{ say } 1\tfrac{5}{8} \textit{ in.}$$

For a cylindrical tubular boiler, the area of grate surface may be taken as 1/25 of the heating surface, or, in this case, 1920 ÷ 25 = 76.8 sq.ft.

The size of the safety valve depends on the area of grate surface and the pressure (absolute) to be developed. But since the grate surface, in different types of boilers, is dependent on the heating surface, and this again is derived from the horsepower developed, the area of the safety valve, exposed to the steam pressure, may be calculated by the following formula; since one standard boiler horsepower is equivalent to the evaporation of 34.5 lb. of water from and at 212 deg. F., and the absolute pressure, at sea level, in this case, is 200 + 15 = 215 lb. per sq.in.:

$$A = \frac{34.5 \times 160}{215} \times 0.214 = 5.5 \textit{ sq.in., nearly}$$

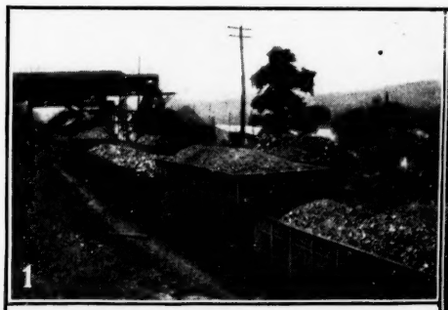
This formula can be written more simply:

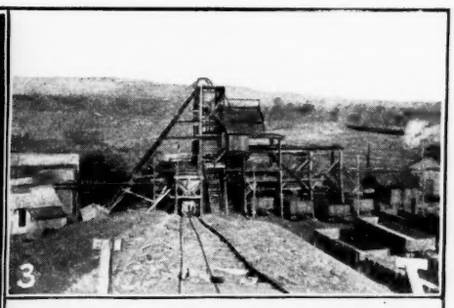
$$A = 7.38 \frac{H}{P} = 7.38 \frac{160}{215} = 5.5 \textit{ sq.in., nearly}$$

This area corresponds to a diameter of say 2¾ in., which is the required diameter of the safety valve for this boiler. The dimension given in this question for the diameter of the boiler is larger than warranted in good practice.

Snap Shots in Coal Mining

We Will Pay $5 for the Best Photograph Published Here Each Week.





1. Tipple and Yard of the Pittsburgh Coal Co.'s mine at Wellsville, W. Va., along Ohio River

2. Self-acting Plane of the Blackwood Coal and Coke Co. at Pardee, W. Va.

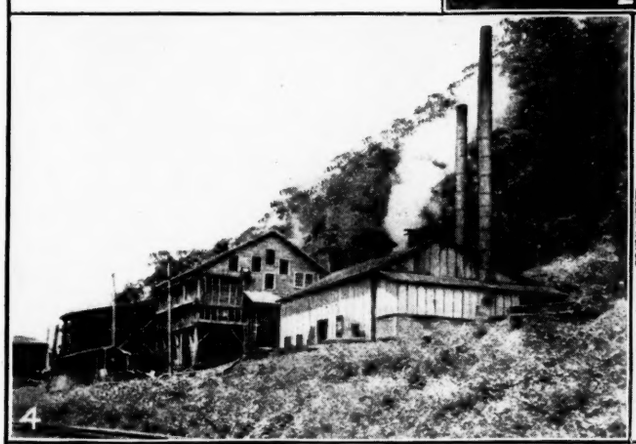
3. Headframe and Tipple, No. 8 Mine, Osage Coal and Mining Co., McAlester, Okla.

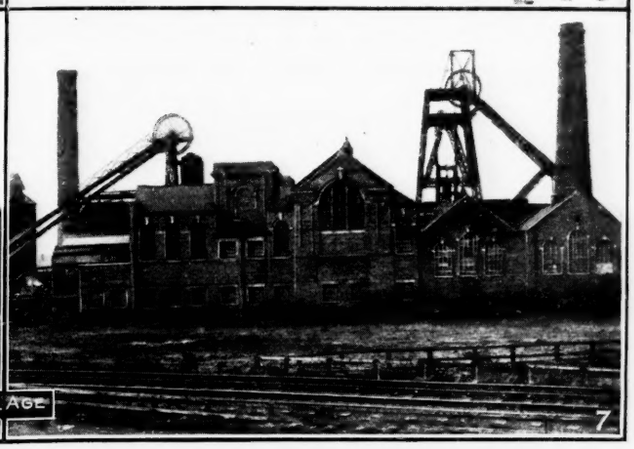
4. Fifty-ton-per-hour Coal Washer of Mary-Helen Coal Co., at Hatfield, W. Va., built by American Concentrator Co.

5. Slope head and Tipple No. 21 Colliery, Dominion Coal Co., at Birch Grove, Cape Breton, N. S.

6. Temporary Tipple at No. 22 Colliery, Dominion Coal Co., Cape Breton, N. S.

7. Boldon Colliery, North-East district of England. Shaft is 1700 ft. deep. Cages have 4 decks each carrying 2 cars. Mine employs 2000 men and boys and has an average output of 3000 tons. Gas has been found in this mine at a pressure of 461 lb. per sq. in. Until recently all coal was mined without explosives





Coal and Coke News

From Our Own Representatives in Various Important Mining Centers

Washington, D. C.

In handing down the so called hard coal opinion, the Supreme Court of the United States has taken action which had long been looked for with extreme anxiety. The verdict is decidedly different from what had been expected, as it appears to be neither wholly in favor of the Government nor of the coal roads. The points won by the Government are seen in the decision of the Court that the so called "65-per cent. contracts" whereby the railroad coal companies purchase the output of independent mines are illegal, while the effort of the roads to shut out a competitive railway from the anthracite region through their control of the Temple Iron Co. is also illegal.

The minor combinations of railroads and coal companies are dismissed because they do not seem to constitute a "general combination," so that it is not esteemed fair to request them to make a combined or general defense against this charge. The prevailing view among those who have followed this litigation most carefully has been that the two methods by which the anthracite companies were able to maintain prices were the 65-per cent. contract and the control of the tranportation side of the business.

Under the 65-per cent. clause, the independent mining companies agreed to turn over all of their output to the selling companies allied with the coal roads and to accept in exchange 65 per cent. of the market price of the coal in New York harbor.

This end of the deal is now held illegal but the transportation side of the problem remains and is still under investigation by the Interstate Commerce Commission. The claim is that the rates for carrying anthracite are about three times as high as those charged on soft coal and if they should be held illegal it is supposed that the companies would be largely stripped of their monopoly power. Owing to the limitations of the decision, and the fact that one of the main points still remains to be determined, it cannot be said that the roads have won a very decisive victory so far but while losing one of the main points at issue, they have deferred the other to the future.

The history of the case is of considerable interest and may be briefly reviewed.

The action was brought against the big factors in the hard-coal trade. The list of defendants was headed by the Reading company, a holding corporation. The railroads made defendants were the Philadelphia & Reading Ry. Co., the Lehigh Valley R.R. Co., the Delaware, Lackawanna & Western R.R. Co., the Central R.R. Co. of New Jersey, the Erie R.R. Co. and the New York, Susquehanna & Western R.R. Co.

The Pennsylvania and the New York, Ontario & Western, two other important roads in the hard-coal field, were not included in the suit. Other defendants were coal companies affiliated with the railroad defendants, and thirty-two "independent" operators who had entered into contracts to sell their output forever to the railroads or their "affiliated" coal companies.

In its suit, the government charged first the existence of a general combination in violation of the Sherman anti-trust law, and then charged that several smaller combinations within the big one were not only in violation of the law themselves, but constituted evidence of a general combination.

The general combination was alleged to have for its object the ending of competition among the defendant railroads in the transportation and sale of anthracite coal, and of preventing the sale of the output of independent operators in competition with the defendants' coal. The combination, it was alleged, transported 77 per cent. of the anthracite coal moving from the mines, controlled over 87 per cent. of all the anthracite in the ground, and produced 60 per cent. and marketed 70 per cent. of the annual output. The lower court was unanimous in holding that there existed no general combination in violation of law.

One of the special things complained of in the suit was the system of "65 per cent. contracts" whereby the "railroad" coal companies agreed to pay the "independents" forever 65 per cent. of the price of coal at New York Harbor. The lower court held these contracts did not violate the law.

Control, through stock ownership, by the Reading company of the Philadelphia & Reading Ry. Co., and the Central R.R. Co. of New Jersey, described as competitive interstate carriers, and also of the Philadelphia & Reading Coal & Iron Co., and the Lehigh & Wilkes-Barre Coal Co., was alleged to constitute a combination in restraint of trade and a monopolization in violation of the Sherman law. The lower court held that in this there had been no violation of the law.

Control, through stock ownership, by the Erie R.R. Co., of the New York, Susquehanna & Western R.R. Co., was alleged to constitute another violation of the law, the lower court held against the government on this point.

Combination of the defendant railroads and "affiliated" coal companies in the Temple Iron Co., with the alleged purpose and effect of forestalling the construction of a projected competitive line and permanently shutting out competition among the defendant railroads and coal companies, was alleged to be another violation of the law. The lower court, two to one, agreed that the defendant railroads and the Reading company were joined by this company into a combination in restraint of trade and in violation of the law.

Acquisition and continued holding by the Erie R.R. Co., of the entire capital stocks of the Pennsylvania Coal Co., the Delaware Valley & Kingston R.R. Co., and the Erie & Wyoming Valley R.R. Co. were alleged to restrain and monopolize trade in violation of the law, but the government lost on this point also in the lower court.

Pennsylvania

ANTHRACITE

Scranton—S. M. Reese has begun suit for $3000 damages from the Peoples Coal Co. and the Lackawanna Coal Co., for damages done his property by mine cave. Similar suits for damages are expected to be filed shortly by property owners living in the vicinity of Reese's home.

Pottsville—The Silver Creek Colliery of the Philadelphia Reading Coal & Iron Co. was closed down Dec. 11, when the men declined to go inside the mine unless about a dozen workmen at the colliery joined the union. This company employs about 1500 men and produces in the vicinity of 3000 tons of coal daily.

Hazelton—The 2500 mine workers, who have been on strike at the collieries at the Lehigh & Wilkesbarre Coal Co., returned to work Dec. 13. Their grievances will be adjusted by the conciliation board.

Pittston—Twelve hundred men and boys went on strike Dec. 9 at the No. 6 colliery of the Pennsylvania Coal & Coke Co. The refusal of a number of engineers and outside workmen to join the union was the cause.

The three shafts are idle and, judging from the attitude of the miners, are likely to be so for some time. A meeting was to be held that night to try to arrive at some agreement.

Shamokin—A convention of the Anthracite United Mine Workers, Districts Nos. 1, 7 and 9, opened Dec. 6, to pass on the proposed revision of the anthracite-mine laws, as presented by a commission of coal-company officials and miners' representatives, appointed by Governor Tener last fall. Portions of the revision were approved and some rejected.

Carbondale—The Carbondale Mining Institute has disbanded because of poor attendance. The balance left in the treasury was divided among the Carbondale hospitals.

Ashland—One thousand men and boys were saved from drowning in the Boston colliery of the Reading company, Dec. 9, when a band of citizens pumped the threatening water from the mine. The colliery is one of the largest owned by the company.

BITUMINOUS

South Bethlehem—The third battery of 75 coke ovens at the Lehigh Coke Co's. new plant near South Bethlehem has been placed in operation. A total of 225 ovens is now in active service.

Uniontown—The Cambria Steel Co. has brought suit against the Sunshine Coal & Coke Co. for $137,708.13 for default of two coke contracts. The Cambria company claims it was compelled to buy coke elsewhere, although it had a contract with the coke company and sought to be reimbursed for its loss.

Meyersdale—Deeds and records of 5000 to 7000 acres of coal land situated in the south end of Summerset County and just across the line in Garrett County, Md., are being examined, and it is said from good authority that if they are found to be all right the options on the said coal will be taken up as a mineral development.

Spangler—The announcement is made that the new company, which has leased 500 acres of the holdings of the Blubaker Coal Co. in the neighborhood of Spangler will shortly let a contract for the sinking in two shafts, each about 100 ft. in depth, and that work on the job is to be started about Jan. 1.

Pittsburgh—Another big coal deal has been reported, W. H. Brown having purchased from J. V. Thompson and others, 1344 acres of coal in the Greene County coking field. The consideration is private, but, estimated on the basis of previous sales of similar coking coal in the same locality, the price would aggregate considerably more than $1,000,000.

Du Bois—The board of commissioners of District 2 have decided that, when pillars or stumps are removed by machine,, the machine-coal price of 37.23c. per ton shall be paid, but that the practice of extracting stumps without the use of a machine at machine price, plus 20c. per car, shall be discontinued. The dispute thus arbitrated arose at No. 1 shaft of the Buffalo & Susquehanna Coal Co.

West Virginia

Charleston—While no proclamation lifting martial law in the strike district has been issued by Governor Glasscock, all the remaining state troops were withdrawn Dec. 13. The military commission concludod its work, but will not be discharged until the governor has approved four sentences passed by it.

There is a rumor in the air that the miners in the New River and other districts will be called out soon after the first of the year.

Alabama

Birmingham—Fire practically destroyed the tipple and washer at the Banner mine of the Pratt Consolidatod Coal Co., Dec. 7. The loss is estimated at between $30,000 and $40,000. No one was injured in fighting the flames and the inside of the plant did not suffer any damage whatever.

Work will be started at once to rebuild the tipple and washer. This will occupy about three weeks' time.

University—A valuable map of the Coosa coal fields has just been published by William F. Prouty, assistant state geologist, showing the streams, main roads, railroads and other culture marks.

Ohio

Cambridge—About 250 miners at the Trail Run Mine No. 2 of the Cambridge Coal Co., walked out on a strike Dec. 9, because it is said the company did not reinstate a man who had been off duty for the past two weeks.

Gallipolis—Coal fleets from Pittsburgh and the great Kenawha River containing 3,000,000 bushels of coal passed down the river Dec. 11 bound for Cincinnati and Louisville. This amount will supply these markets for some weeks. The tow boat, "Sam Clark." struck an obstruction near dam 26, sinking one loaded barge.

Illinois

Duquoin—Fire destroyed the boiler shop, engine house, machinery and a part of the tipple at the Brilliant Coal Co., on Dec. 7, entailing a loss of about $5000.

Hanna City—The Applegate & Lewis Coal Co. is installing another motor, and several mining machines, in its mine. When present improvements are completed, they will be able to hoist about 1500 tons of coal per day.

Taylorville—Local financiers representing the Taylor interests, of Chicago, recently closed options on 30,000 acres of coal right, north of Taylorville, and deposited in the local bank $300,000 for the payment of land owners. The Taylor interests plan to extend the local mining field.

Pana—The $75,000 damage suit of the Smith-Lohr Coal Co., and the Pana Coal Co., has been settled. The terms were drawn up in a contract, and the amount, which is not given, was paid over to the Smith-Lohr Co. This company alleges in its bill that it was damaged $75,000 for encroachment on its territory and the use of its coal by the Pana Coal Co.

Iowa

Des Moines—Fire at the Keystone Coal Mining Co's. plant recently destroyed the washhouse and contents, entailing a loss of about $1000. The washhouse was insured.

Kentucky

Lexington—The December meeting of the Kentucky Mining Institute was held at the College of Mines and Metallurgy at the State University, Dec. 9.

Louisville—The Williams Coal Co. and the Taylor Coal Co., of McHenry, Ohio County, have filed a complaint against the Illinois Central R.R., asking the Interstate Commerce Commission to compel the road to furnish cars enough to keep their miners working.

Missouri

Joplin—The strike in the Mayer mine No. 1 at East Mineral has been settled, and the men returned to work Dec. 9 after an idleness of several days.

The strike among the miners employed in the eight mines of the Sheridan Coal Co. has also been settled, and the miners returned to work.

Tennessee

Bristol—The property of the Dominion Coal & Coke Co. in Lee County, Va., was sold at public auction Dec. 7, and was bid in by G. W. Bondurant, at $55,000. This makes Mr. Bondurant, with but few exceptions, the largest operator in Lee County. The aggregate output of his mines will be 25,000 tons of coal monthly.

Oklahoma

Mutual—While drilling a well on his farm three miles west of here, A. C. Miles, at a depth of about 65 ft., struck an 8- or 9-ft. seam of what appears to be a good quality of coal. Business men here are jubilant, and a prospect shaft will be sunk at once.

Mississippi

Eldon—It is reported that B. W. Lansdown has struck coal on his farm, near Eldon. The coal is of the cannel variety and seems to be good.

Foreign News

HAWAIIAN ISLANDS

Honolulu—It is rumored that a German syndicate is to come into possession of Christmas Island and will convert it into a coaling station for the supply of the Pacific trade.

Personals

Josiah Kealey, for some time past superintendent of the Shinnston mine No. 32 of the Consolidation Coal Co., has been promoted to assistant to the general superintendent of mining, at Tarleton.

J. J. Gourley, of Punxsutawney, Penn., has been appointed superintendent of the

Bear Run Coal & Coke Co.'s mine, at Sidney. Mr. Gourley was formerly superintendent for the Anita Coal Mining Co.

Vice-President John T. Hendricks, of the Western Maryland Ry. Co., in charge of both freight and passenger traffic, and well known to all of Baltimore's coal operators, has resigned his position here to become general traffic manager of the Missouri Pacific and Iron Mountain systems. He will enter upon his new duties on Jan. 1.

In addition to the changes in the Chesapeake & Ohio C. & C. Co., noted in a recent issue of COAL AGE, 12 others of the office force have left; chief clerks, coal inspectors, shipping agent, stenographers, etc., and the Newport News office has been closed. The new organization is as follows: Franklin Guitermann, president and chairman of the board; S. R. Ritchie, assistant to president; O. W. Gardner, manager of sales; L E. Arnott, assistant treasurer; J. W. Moore, field agent.

Construction News

Wheeling, W. Va.—One of the largest mines in the state is being opened below Shadyside by the Geo. M. Jones Coal Co.

Wilkes-Barre—A new breaker will be started in Plymouth within the next few days by the Dunn Coal Co., with headquarters in this city.

Brownsville, Penn.—The Brownsville Engineering Co. is doing preliminary work on a new coke plant, to be erected at Big Meadow Run.

Nokomis, Ill.—The actual work of sinking the mine of the Nokomis Coal Co. began Dec. 6. Both the main and air shafts are expected to be finished by July 4, 1913.

Du Bois, Penn.—Over 300 men are now employed on the big coke oven contract for the Cascade Coal & Coke Co.. Foundations for some of the ovens have already been started.

Shamokin, Penn.—A force of men in the employ of the Mineral R.R. and Mining Co. has commenced work on the erection of a large washhouse at the Pennsylvania colliery.

Philadelphia, Penn.—The Brown-King Construction Co. has a contract to build a coal pocket and trestle, 18x145 ft., on Westmoreland St., north of Trenton Ave., for Owen Leiter's Sons. The cost will be $11,000.

Bellaire, Ohio—A new mine is being opened up a few miles south of this city which, when completed, will be the largest in Belmont County. The mine is owned by the George M. Jones Coal Co., and will soon be ready for operation.

Glace Bay, N. S.—The Dominion Coal Co. has recently equipped a subrescue station to serve the new collieries, which will supplement the main station at Glace Bay. A rescue station is also in course of erection at the Springhill Collieries.

Youngstown, Ohio—The Youngstown Sheet & Tube Co. is taking up plans for building a battery of byproduct coke ovens. The company requires about 60,000 tons of coke per month, and has been one of the largest buyers of coke in the Pittsburgh district.

Connellsville, Penn.—It is expected that the United Fire Brick Co. will construct in the next two or three months a new coke plant near Ferguson, which will be one of the best equipped in the coke region. This company controls about 10,000 acres of lower Kittanning coal.

Altoona, Penn.—The Penn Central Light, Heat & Power Co. has begun the work of running its power line branches to the mines of the Juniata and Hughs companies, and to the workings of the Pennsylvania Coal & Coke Co. A new substation is being erected at Sonman and a huge transformer is to be installed there.

Charleroi, Penn.—The Monongahela Consolidated Coal & Coke Co. is preparing to make a new opening of a mine 600 ft. south of the Eclipse mine, above Roscoe. The desire is to attain a daily output of 3500 or more tons. It is understood that plans are drawn for a large steel tipple and that work on it will start immediately. It is expected that the new mine will be put into use by next July.

Arcadia, Penn.—The Pennsylvania Coal & Coke Corporation is erecting a new power plant next the side of the old plant, and within the near future the output of the mines will be greatly increased. The new plant will contain six batteries of 200-hp. boilers and will be built of steel and brick, 40x60 ft. It is hoped to have the work completed by the first of the year. Electric haulage and cutting machines are used in the mines.

Glace Bay, N. S.—The Dominion Coal Co. has recently completed the erection of a "Baum" coal washer, having a capacity of 120 tons per hour. This is the first washer of this type to be erected in America. Another departure by the same company is the installation of Bettington boilers at a new electric generating station to serve a group of six new collieries. These boilers use dust fuel, and are the first of their kind on this continent.

Phillipsburg, Penn.—The Cunard Co. began work Dec. 5 in developing 1600 acres of a 5-ft. vein of bituminous coal at Morrisdale, Clearfield County, which will require 50 years to mine. Modern machinery and electric power and haulage will be installed. Two thousand tons a day will be shipped until the heart of the deposit has been reached, when the output will be greatly increased. The coal will be shipped over the New York Central R.R. Charles B. Maxwell, superintendent of the Morrisdale Coal Co., is the new company's manager.

Dunham, Ky.—It is stated by officials of the Consolidation Coal Co., one of the most prominent operating companies in the Harlan field, and Eastern Kentucky generally, that construction work is to be started at once on the extension of the Sandy Valley & Elkhorn R.R. from Dunham to McRoberts. The survey has already been completed, and the building of the road will involve the construction of a tunnel a mile long. The immediate building of the extension is said to be due to difficulties which the Consolidation has had regarding the shipment of its coal from McRoberts over the Lexington & Eastern.

New Incorporations

Frankfort, Ky.—The Yellow Creek Coal Co., Middlesboro; increasing capital from $25,000 to $40,000.

Ottumwa, Iowa—Trio Coal Co. Capital, $10,000. Incorporators, Howell Price George West and James Nevin.

Boston, Mass.—H. T. Schaefer Co., Inc. coal and coke, $10,000; Henry T. Schaefer, Ottilie E. Schaefer, Harry J. Jacquith.

San Antonio, Tex.—Poteet Coal & Sand Co., of San Antonio, filed an amendment increasing its capital from $15,000 to $50,000.

Frankfort, Ky.—Big Sandy Fuel Co. Ashland; capital stock, $10,000; incorporators, Ralph Chatfield, M. Chatfield and O. P. Chatfield.

St. Louis, Mo.—Formastat Mining Co. Capital, $60,000. Incorporators are: Arthur R. Deacon, Marion L. Lambert and Albert B. Lambert.

Augusta, Maine—The Midway Development Co.; general mining and developing. Capital, $75,000. President and treasurer, E. M. Leavitt, Augusta, Maine.

Chicago, Ill.—The Buchanan Coal Co., of Chicago, has been incorporated with $150,000 capital. The incorporators are John C. Martin, John J. Sherlock and M. C. Putnam.

Chicago, Ill.—The Roseland Coal & Wood Co. has been incorporated with a capital stock of $5000. The incorporators are John Gregor, Jr., Jos. Yuknis and Kazimiera Yuknis.

Birmingham, Ala.—Tuscaloosa Export Coal Co. has filed notice in the probate office of the increase of capital stock from $2000 to $25,000. The company is developing coal properties in Tuscaloosa County.

Kittaning, Penn.—The company which has recently acquired the coal property of Joseph G. Beals & Co., Inc., has now changed its corporate name and will hereafter be known as the Armstrong County Coal Co.

Bristol, Va.—Volunteer State Mineral Co., Inc., S. L. Hudson, president, Smyrna, Tenn.; E. B. Tucker, vice-president, Smyrna, Tenn.; E. C. Holliway, secretary and treasurer, Smyrna, Tenn. Capital, $10,000 to $50,000.

Lockland, Ohio—The John Mueller Co., of Lockland, Ohio, has been incorporated with a capital stock of $50,000, to deal in coal and builders' supplies. The incorporators are John Mueller, Herbert Mueller, Albert J. Mueller, Joseph Vedder and John J. Wright.

Meyersdale, Penn.—Application will be made Dec. 27 by Clyde J. Rowe, Clarence F. Rowe and Frederick E. Rowe for the charter of an intended corporation to be called C. J. Rowe & Brothers, the character and object of which is mining, digging and drilling of coal.

Louisville, Ky.—Articles of incorporation have been filed for the Low [illegible] Coal Co., with a capital stock of $25,000. The incorporators are G. R. Hunt, E. N. Chain, W. O. Alden. The company proposes to lease, purchase and operate coal lands in the State of Kentucky and elsewhere. The headquarters of the company will be in Louisville.

Brownsville, Penn.—Incorporation papers have been granted to and work has been begun by the West Penn Coke Co.

which will enlarge its 25-oven plant near Hecla, Westmoreland County. The incorporators are Richard Davis, Jr., of Uniontown; Holmes A. Davis, of Wilkinsburg, and John J. and Ernest Hillman, of Pittsburgh. The capital stock is $50,000.

Industrial News

Cambridge, Ohio—The Marietta and Lake coal testers are drilling their second test hole on the Madowell property.

Connellsville, Penn.—The Echard Coal & Coke Co. has contracted for the sale of its 1913 output of coke to the Whyell Coke Co., of Uniontown, for $3 a ton.

Hazleton, Penn.—The Lehigh Valley Coal Co. has asked for and received bids to strip the Mammoth vein which lies to the northeast of Laurel Hill in the Hazleton region.

Altoona, Penn.—Ebensburg Coal Co. has secured about 2500 additional acres of valuable coal lands in Cambria township for consideration of from $85 to $95 per acre.

Connellsville, Penn.—The Jamison Coal & Coke Co. has opened a new tract of coal on the west side of its mine at Hannastown, and is working it by a night shift. Electric haulage is to be installed.

Henderson, Ky.—The Moser Mining Co., operating the Keystone coal mines in this district, has made an assignment for the benefit of its creditors, with assets and liabilities each amounting to about $2500.

Knoxville, Tenn.—A new mine will be opened by Adler Brothers, at a cost of $100,000. Edgar Adler, of that company, which recently acquired the Musgrove holdings, said yesterday that the construction would take place soon.

Meyersdale, Penn.—S. J. Christner, of Elk Lick Township, has stated that the deeds and records of 7000 acres of coal land in that section of the country are being examined. If found all right, options will be taken up within 60 days.

North Sydney, N. S.—The Nova Scotia Steel Co. has lately fitted out a rescue car, which will serve their scattered collieries. The car is fitted with Draeger apparatus and oxygen supplies, first-aid appliances and fire-fighting equipment.

Connellsville, Penn.—Captain Alfred Hicks, of Pittsburgh, has sold his entire interest in the Belmont Coal Mining Co. to Thomas K. Maher, vice-president and general manager. The company will soon be reorganized and its headquarters removed to Cleveland.

Lonaconing, Md.—A new 12½-hp. gas engine was installed, Dec. 3, in mine No. 2 of the Georges Creek Coal Co. to drive a 6-ft. fan. The engine was manufactured by the Bessemer Gas Engine Co. and is the same as those operated by the Maryland Coal Co.

Washington, Penn.—W. F. Patterson, of Waynesburg, Penn., has closed a coal deal in which he has disposed of 800 acres of the Pittsburgh or River vein of coal to L. F. Ruth and E. K. Dick, of Connellsville, Penn. Mr. Patterson took in part payment property in Connellsville valued at $250,000.

Byesville, Ohio—The Valley mine, formerly belonging to the Cambridge Coal Co. and now operated by J. H. Opperman and J. C. Orr, receivers, is facing an indefinite shutdown due to a cave-in of the Daniel Orr Creek bottom. The mine is badly flooded and the exact conditions are hard to determine.

Paducah, Ky.—The car department of the Illinois Central is being worked to its fullest capacity to turn out cars for the mines. There is a great demand for cars all over the system, especially at the Kentucky mines. The yards contain several hundred bad-order cars.

Pottsville, Penn.—The Silver Creek colliery of the Philadelphia Coal & Iron Co. was closed down by a strike, Dec. 11. The men declined to go inside the mines unless about a dozen workmen at the colliery joined the union. The company employs about 1500 men and produces about 2000 tons of coal daily.

Whitestone, Ky.—It is reported that an Eastern syndicate composed of New York and Philadelphia capitalists has completed a deal whereby 5000 acres of rich coal lands lying along lower Carr's Fork Creek, south of the town, will immediately be developed. The property lies only a few miles from the line of the Lexington & Eastern.

Johnstown, Penn.—There have been persistent rumors for some time to the effect that the Berwind-White company is figuring in a gigantic coal deal, by which it would acquire the holdings of a number of companies in Somerset County. W. R. Calverly, superintendent of the Berwind-White operations, denies that his company has any big deal on foot.

Birmingham, Ala.—Only a few more days remain for the Alabama mines to make the record production for 1912, and some of the mines will close down, Dec. 15, until after the holidays. So far, the indication is that the 1912 output will break all previous records. For the first time in several years most of the mines were operated on full time Thanksgiving Day and made good records.

Connellsville, Penn.—Fayette County capitalists purchased 2300 acres of coal five miles west of Clarksburg, on the Baltimore & Ohio R.R. Cyrus Echard, Edmund and Harry Dull and Kell Long, Connellsville, Penn.; David and Joseph Long and John and James Parkhill, near Laurel Hill, and R. E. Umbel, John S. Douglas, Jefferson Walters and Lewis M. Dawson, Uniontown, interested.

Johnstown, Penn.—The Loyalhanna Coal Co. has begun operations at the site of its new coal-mining town south of Reitz, Shade Township, Somerset County. The machinery for the opening of the veins is already on the ground, and the work will proceed throughout the winter, the mines being ready to send out coal just as soon as the railroad extension to that point can be completed.

Spokane, Wash.—The Spokane Stock Exchange has just added the McGillvray Creek Coal & Coke Co., Ltd., to the board. The company is capitalized for 3,000,000 shares having a par value of $1 each, and the property consists of 2600 acres located at Coleman, Alta. It is now producing about 600 tons per day. The officers of the company are L. A. Campbell, president; J. A. Howell, vice-president, and W. E. Cullen, secretary.

Hamden, Ohio—The Morrow Coal Co., of Wellston, today drilled through 38-in. vein of pure No. 2 coal, which was struck at a depth of 255 ft. from the surface on the Fitzpatrick farm, four miles southeast of this place in Jackson County. The tract which contains 616 acres is owned by John T. Ogier, of Hamden, and J. H. Sellers, of Wellston, the same having recently been leased to Frank Morrow, of the latter city.

Shamokin, Penn.—A new electric air compressor, the first to be used in this region, arrived at the Locust Spring colliery at Locust Gap last Friday, and will be used in sinking a new rock slope about a mile east of the colliery. Within a short time the power from this plant will be used at the Potts colliery, near Locust Dale. The same plant will furnish power for the trolley line now being erected from Alaska colliery to Red Ridge.

Sydney, N. S.—A briquetting plant has been put into commission by the Colonial Coal Co., whose mine is situated near Sydney. This plant is making a commercial product from an unsalable slack that is meeting with a good demand. The pitch binder is obtained from the Dominion Iron & Steel Co.'s byproduct plant. It is more than probable that the Colonial company's example will be followed by some of the larger operators of the province.

Cumberland, Md.—Owners of coal lands in the Meyersdale field in the vicinity of Berlin, Somerset County, Penn., have received word that the options on their lands will be lifted at $50 per acre. The deal involves about $300,000. Each owner will sell from 75 to 350 acres. It is said the men who took the option are Eastern capitalists close to the Pennsylvania R.R. The field embracing 6000 acres adjoins the holdings of the Consolidation Coal Co. among others.

Coshocton, Ohio—For the first time in the history of Coshocton County coal is now being taken from the ground by the surface-mining process. At the Locust Grove mine, south of the city, owned by John Williams, a force of men and a big steam shovel are at work digging the dirt from the top of the hill. There is a very large supply of coal in the vein, and it is assured that this surface-mining process will continue to go on for some time to come.

Cambridge, Ohio—One of the largest and most important coal deals made in Guernsey County in recent years was made last week when the Cambridge Collieries Co. purchased the interest in the Belle Valley Coal Mining Co. in the Caldwell and Laura mines located on the Marietta Division, near Caldwell. The Caldwell and Laura mines when running in full capacity produce about 3000 tons daily. With this purchase the Cambridge Collieries Co. now owns and operates 12 mines in the Guernsey Valley with a total output of about 15,000 tons daily. There will be no change in the force of the mines at present.

McArthur, Ohio—A. J. and Pearley Graves are the owners of about 1000 acres of land in this and Ross Counties, located near Ray. They have spent nearly $1000 in their efforts to develop the coal on the land, but were not successful. Not long ago they leased the land to a company and the latter has succeeded in finding the coal. The company has put down several holes and have found a vein of No. 2 coal 42 in. thick. Land is well situated for operation, and the company which has been lucky enough to secure the lease and find the coal expects to operate the property extensively.

Coal Trade Reviews

Current Prices of Coal and Coke and Market Conditions in the Important Centers

General Review

The hard-coal market is in a decidedly tense and uncertain position. At points contiguous to the mining regions supplies are more plentiful and premiums on all grades have suffered a sharp decline, but in the more remote localities, the outlook is still serious.

In the New England coastwise trade, hopes of getting better shipments are being dispelled by a succession of storms; vessels are overdue, and many barges are waiting power to move them. On the whole the diverting of the Lake tonnages into the Eastern markets is not relieving the situation much and a sharp fall in temperature will undoubtedly precipitate a runaway market.

The Eastern bituminous situation has suffered a slight reaction during the week and the market is less active, but prices remain steady. The customary suspension of mining over the holidays will doubtless result in a slight flurry around Jan. 1, and prices for the New Year are now being discussed. The scarcity of cars at the mines is the principle feature now, and this has been rather aggravated by a sudden drop in temperature.

Mines in the Pittsburgh district are receiving a fair allotment of cars and probably have a sufficient supply for average needs; prices for prompt shipment are down to only slightly above contract figures at which they are being rigidly held. There has been a heavy increase in production in Ohio, some operators getting up to between 75 and 90 per cent. capacity. The steam trade is strong and active with industrial concerns taking advantage of the increased production to stock up. Hampton Road shippers are gradually catching up on orders, but there are still a large number of vessels awaiting tonnage.

In the Middle West the temperature has been rather mild and quotations on nearly all grades are uncertain. A better supply of cars has enabled the mines to materially increase their production. Hard-coal supplies at the head of the Lakes are heavier than ever before.

Boston, Mass.

The bituminous situation shows a slight reaction from a week ago. Prices on the Pennsylvania grades are not off any, but the market is less active. The slow movement of water transportation for ten days or so will have an effect on the visible supply at this end, and with the usual holiday suspension on top of all the other conditions there seems every chance of a flurry around Jan. 1. All-rail there is already some speculative coal offering and quotations are firm. A blocking snow storm in the next fortnight would send prices soaring.

There is discussion now over prices for next year. The best opinion is that there will be an effort to net better returns on Pocahontas and New River contracts than have prevailed in recent years. The last time a contract price of $3 or more was attempted was in April, 1903, after the big strike, and the attempt was a failure. There are enough Pennsylvania coals that are favorably regarded in this market to prevent too high a level on those from West Virginia. All concede, however, that 1913 figures will be higher than for a year or two past.

Colder weather has given anthracite the serious turn that was expected. Hopes of better shipments in December are fading before the succession of storms along the coast. There are ten ocean tugs overdue from Boston to Philadelphia and that means a sizable shortage in what all the year has been for New England the most dependable source of supply. Loaded barges have been waiting for power in some cases for ten days and dealers are very anxious over the outlook. Boston retail prices are still on the basis of $8.25 delivered for stove, or 75c. up from a year ago.

Current wholesale quotations are about as follows:

Clearfields, f.o.b. mine	$1.50@1.95
Clearfields, f.o.b. Philadelphia	2.75@3.20
Clearfields, f.o.b. New York	3.00@3.50
Somersets, Cambrias, f.o.b. mine	1.65@2.00
Somersets, Cambrias, f.o.b. Philadelphia	2.90@3.25
Pocahontas, New River f.o.b. Hampton Roads	3.50
Pocahontas, New River on cars Boston	4.50@4.75
Pocahontas, New River on cars Providence	4.45@4 75

New York

Anthracite—The hard-coal market has recovered somewhat from the sharp break which it experienced last week. Dealers are again becoming urgent in their demand and showing a decided anxiety over the outlook. This is probably due to a tightening of the car situation on the anthracite roads and a fall in temperature. It is becoming more evident, however, as the season advances, that there is little probability of the situation reaching an acute stage at this point. While business is yet of an entirely hand-to-mouth character, shipments appear to be increasing and the tension which has characterized the market up to the present is materially less.

We continue last week's quotations as follows:

	Upper Ports	Lower Ports
Broken	$5.00	$5.00
Egg	5.25@6.00	5.20@5.90
Stove	5.25@6.50	5.20@6.50
Chestnut	5.50@6.50	5.45@6.50
Pea	3.50	3.45@3.60
Buckwheat	2.75	2.25@2.60
Rice	2.25	1.80@1.95
Barley	1.75	1.25@1.70

Bituminous—Shipments into New York have materially increased and are now quite heavy. The trade, however, experiences no difficulty in absorbing all the tonnages that can be obtained without any break in prices. Quotations continue firm on about the same basis as last week and it is doubtful if much free coal could be obtained at less than $3.15.

The car situation in the mining regions is only about fair on an average, and particularly bad on the Pennsylvania R.R. Other lines have been meeting requisitions for shipment in a fairly satisfactory manner and giving about sufficient cars to meet with the requirements of the operators. The wholesalers are now beginning to anticipate the holiday suspension of work at the mines by endeavoring to accumulate some surpluses. This curtailment will go in effect next week and will continue for a week or ten days.

We continue last week's quotations as follows:

West Virginia, steam	$3.10@3.25
Ordinary grades, Pennsylvania	3.10@3 25
Fair grades, Pennsylvania	3.10@3 25
Good grades, Pennsylvania	3.10@3.25
Best Miller, Pennsylvania	3.10@3 25
Georges Creek	3.50

Pittsburgh, Penn.

Bituminous—Car supply is improved slightly in quarters where there was the most complaint last week, but is still unsatisfactory at all mines, though, as a rule, there is sufficient for all the operation desired. Prices for prompt coal are but little above regular contract figures, which are being fairly well maintained.

and rigidly so by some of the operators, as follows: Slack, 90c.; nut and slack, $1.05; nut, $1.25; mine-run, $1.30; ¾-in., $1.40; 1¼-in., $1.55 per net ton at mine, Pittsburgh district.

Connellsville Coke—Demand for prompt coke, while not large, is ample to take up all offerings, and the market continues firm at previous quotations, $3.90 @4 for prompt furnace, with the higher figure frequently obtained. Dealers who can hold back coke are doing so, expecting a better market around the holidays, when there is invariably a shortage of some extent, while operators are endeavoring to stock up their contract customers against this contingency. The considerable amount of inquiry for contract coke, noted a week ago, is still in the market, it being difficult to close on account of limited offerings. We quote: Prompt furnace, $3.90@4; contract furnace, first half, $3.25@3.50; contract furnace, year, $3@3.25; prompt foundry, $4.25@4.50, contract foundry, $3.25@3.75, per ton at ovens.

Philadelphia, Penn.

Dealers in this vicinity are still complaining over their inability to get any supplies of coal. The demand, particularly for stove, chestnut and pea, is far in excess of the receipts. One large dealer here reported that at the close of business last week, he did not have a ton of stove coal, and only a few loads of nut. The demand for egg is easing up somewhat, and it has been suggested, that in the present situation, it might be well to try and induce customers to use this size, instead of stove and chestnut.

The diversion of coal eastward, and the cessation of navigation on the Lakes, does not seem to have materially increased the tonnage for this market. While there was undoubtedly large quantities of coal going westward, at the same time, the vast territory in the East requires a great deal of coal, and the tonnage diverted this way would hardly be perceptible when absorbed by the great demand that is now on. It is understood that what stocks of pea coal the large companies had, has been cleaned up, and the current production will have to supply the market from now on through the winter.

Baltimore, Md.

Had the weather conditions been different from what they were, the calculation made by consumers might have been correct, but the quick drop in temperature, which in many instances, interfered with the movement of traffic to and from the mines, created a situation far different from what was anticipated by buyers. Coal could not be sent to its destination as quickly as heretofore, or the empties returned to the mines as promptly as demanded by operators. Consequently, the trade found that it was a difficult proposition to get anything like the equipment necessary to meet the urgent demand, and with the restricted supply which resulted, the price level was raised. The early part of the week, one of the largest operators in Baltimore reported that low grades of fuel dropped to below $1.50 per ton, but as a result of the changed conditions during the last three days of the week, this same coal was eagerly sought by consumers at $1.65 and $1.70. The greatest demand was for the low grades.

Buffalo, N. Y.

There is some hesitation over the asking price of bituminous coal, especially Eastward. A Buffalo operator who has just spent several days on the Atlantic Coast finds that while the asking price is $1.60 net at the mines for mine-run, the consumer often refuses to pay this. The inference is that more coal is selling direct from the mine to the consumer than formerly.

The attitude of the railroads is causing much uneasiness. The Pennsylvania especially stocks no coal, but gives various mines on its line a spring order for a maximum quantity. The price this year was $1.10 net, but during the slack months, when coal is plenty, it took only about half what it is taking now, with prices 50c. higher than it is paying.

There is said to be considerable burning of bituminous coal for anthracite, especially in isolated sections. A report comes from the St. Lawrence River district that the change to bituminous brought about by the anthracite scarcity, will be large this winter. The fact remains that anthracite is becoming more plenty since the closing of the Lake trade, for the premium paid for independent hard coal is now only $1.50 a ton, in place of $2.50.

Bituminous prices are a trifle easier now, though there are still some fictitious quotations given out for the purpose of influencing the market. There are more reports of offerings at reduced prices, but as a rule they come to nothing when investigated. General quotations will therefore remain at $3 for Pittsburgh lump, $2.85 for three-quarters, $2.75 for mine-run and $2.50 for slack. Coke is still strong at $6.50 for best Connellsville foundry.

Columbus, Ohio

Conditions throughout Columbus and vicinity showed a marked improvement during the week. The mines are working to a better advantage and it is said that some operators are now up to about 75 to 90 per cent. of normal. Salesman have been ordered out on the road again and it is expected that when the industrial concerns are through stocking up, which will probably be about the first of the year, more attention can be given to domestic trade. The car situation shows quite an improvement over last week.

There is a falling off in the domestic trade, which is attributed to the mild weather, but if the temperature should take a sudden drop there would be an active demand for this grade; as it is dealers seem to think that the prices will take a slump and then they can stock up. If the present conditions keep up there will in all probability be a drop and dealers claim that they will not then be able to even up on account of the losses suffered through the curtailment of business by the car shortage.

The steam trade is active at this time of the year as industrial concerns seem to be availing themselves of every opportunity to stock up. Yard trade is a little slow at this time, but this is expected to grow better when the steam trade takes a slump, which is anticipated after the first of the year.

Quotations in Ohio fields are:

	Hocking	Pittsburgh	Kanawha	Pomeroy
Domestic lump	$2.00		$2.25	$2.35
2-in.	1.80	$1.60	2.00	2.00
Nut	1.50			2.00
Mine-run	1.50	1.50	1.75	1.75
Nut, pea and slack	1.00		1.10	1.25
Coarse slack	0.90	1.25	1.00	1.00

Hampton Roads, Va.

With vessels lying in Hampton Roads for approximately 75,000 tons of coal, a fair idea may be obtained of the local situation, as compared with the past three weeks. Shippers are gradually catching up on their obligations, but conditions are not as yet such as to warrant any rejoicing. The most noteworthy feature to date this month is the dumping at the Sewells Point piers; these usually ranking third, are now some 10,000 tons ahead of the Newport News piers. During the past week announcement was made that several large mines having an outlet to Hampton Roads over the Chesapeake & Ohio Ry. only, have been connected with the Virginian Ry. also, thus affording a double outlet. The railroads still continue to confiscate coal in transit, causing considerable trouble to shippers.

During the past ten days a large number of bunker steamers have put into Hampton Roads for coal. These are mostly all loaded with cotton from the Southern ports and bound for European points. It seems to be the general impression that more bunker coal is taken here each month during the past year than in the corresponding months of any previous year.

Birmingham, Ala.

Roughly compiled figures show that the coal shipments from Alabama mines during September, October and November are somewhat below those for the record years, this shortage being due solely to

lack of shipping facilities. The tonnage being handled at present is breaking all records.

The demand for domestic coke continues to increase, and also the price. In addition to the requisitions from the Coast towns heretofore using anthracite coal, orders have been booked for three to four hundred cars for shipment to Missouri, Kansas and Nebraska. The domestic coke from byproduct coke ovens, while new in this territory, is proving to be a very popular and economical fuel.

The market for foundry coke is brisk and spot sales were made during the current week at the record price of $4.25 per net ton.

Louisville, Ky.

A few days of colder weather during the past week resulted in a somewhat increased domestic demand, but some reports are to the effect that the customary December dullness was not materially affected, as domestic stocks laid in during the summer and early fall are unusually large. Dealers' stocks are low, however, and a prolonged season of really cold weather will undoubtedly result in a serious local shortage. Steamboat men are said to be offering $1.75 for mine-run in western Kentucky, without success, as all of the larger mines are out of the market. A few small operators are quoting $1.50 for lump, $1.15 for nut, and 75 to 85c. for nut and slack, but these prices are not obtainable for any considerable tonnage. The Southern Railway, which does not seem to be suffering from the pronounced car shortage, is bringing in a little Indiana coal, which has heretofore been little handled here.

Knoxville, Tenn.

Within the last two weeks there have been sensational developments in the car-supply situation in the Kentucky-Tennessee field. At the recent informal meeting in the rooms of the Southern Appalachian Coal Operators' Association in this city, operators on the Southern Railway declared that the car supply had reached a stage where the Southern Railway must do something.

On roll call it was shown that the shortage for the preceding week had run from 60 to 100 per cent., and it was stated the companies loading for the railroads were the only ones receiving cars. One operator stated that he had no cars for the past week and the Southern Railway told him that he would get them only on the condition they would be loaded for the railway company, and this condition would continue through December.

On Dec. 12, operators on the L. & N. received notice that between Dec. 16 and 25, all coal loaded on Mondays, Wednesdays and Fridays of each week would be taken by the railroad company at $1 per ton of mine-run. After an informal discussion among the operators, the road receded from its position and agreed to take a small grade which could be produced by most operators at a profit. Some have accepted but the large commercial producers say it will demoralize their trade and the situation has caused much dissatisfaction generally.

Detroit, Mich.

Bituminous—The situation in bituminous coal is becoming rather uncertain and is not so good as it was a few days ago. Operators are taking care of their contracts and shipping very promptly from the mines, but the congestion remains unchanged. Both the steam and domestic coals are showing decided weakness of late. The manufacturers and dealers, with a few exceptions, report that they are well stocked. This is due to the unusually mild weather. Pocahontas is declining very rapidly, and is being quoted about 60c. per ton below last week's prices. A few weeks ago, the same coal was bringing from $1.75 to $1.85, with very little on the market.

Contract buyers are ordering satisfactorily, but shipments are made difficult by poor car service. Jobbers are receiving very much coal at present, but they find some difficulty in getting sufficient to fill orders on the smaller sizes.

Prevailing prices are as follows:

	W. Va. Splint	Gas	Hocking	Pocohontas	Jackson Hill	Cambridge
Domestic lump	$1.70		$1.70	$2.25	$2.50	
Egg	1.70		1.70	2.25	2.50	
¾-in.	1.50	$1.50	1.50			$1.60
Mine run	1.35	1.35	1.35	1.35		1.40
Slack	1.10	1.10	1.05	1.05		1.00

Anthracite—Anthracite is coming along better than a week ago. The situation is, of course, far from normal, but the outlook for an increased supply before real cold weather sets in is good. The extraordinary premiums which prevailed in November are not in evidence this month, and the independents are often glad to get just a slight advance above circular prices.

Chicago

The recent cold wave and the decision of the Interstate Commerce Commission ordering the Western railroads to return the cars of the Eastern lines has made the Chicago market particularly strong, although prices have not advanced to any material extent. As a result of the commission's order one railroad in Chicago received 6000 coal cars in one day.

A reasonably strong market has been noted on smokeless mine-run, all shipments which arrived unsold being disposed of on a basis of $1.40 to $1.50 f.o.b. mines. Prices on lump and egg still continue at $2 to $2.25. The anthracite situation is tightening up, owing to the colder weather; having taken care of the Western trade early in the year the operators are now beginning to concentrate shipments into the East.

Prevailing prices at Chicago are:

	Sullivan Co.	Springfield	Clinton	West Va.
4-in. lump	$2.87			
Domestic lump		$2.57	$2.52	
Egg	2.62			$3.55
Steam lump		2.12	2.27	
Mine-run	2.07@2.17	1.97	2.02	3.55
Screenings	1.62@1.67	1.47@1.57	1.52	

Coke—Prices asked for coke are: Connellsville, $6.75@7; Wise County, $6.75@7; byproduct, egg and stove, $6@6.25; byproduct nut, $6@6.25; gas house, $6.

St. Louis, Mo.

The market here is still in bad shape; there is no demand for either steam or domestic, and practically everything is at a standstill. This is caused chiefly by the remarkably open winter we are having. Indications are that the market will remain this way until about the first of the year, unless we have some severe weather about Christmas time. Car shortage is the only thing that is keeping the prices above the cost of production now.

The prevailing prices are:

Carterville and Franklin County	
6-in. lump and 3x6 egg	$1.50@1.65
No. 1 nut	1.25@1.40
No. 2 nut	1.20@1.30
2-in. Screenings	0.80@0.85
Mine-run	1.20@1.25
No. 1 washed	1.90@2.00
No. 2 washed	1.50@1.60
No. 3 washed	1.25@1.30
No. 4 washed	1.10@1.15
No. 5 washed	0.85@0.90
Murphysboro Big Muddy	
Lump and egg	$2.35
Trenton	
Lump and egg	$2.25
Mount Olive	
6-in. lump	$1.75
2-in. lump	1.40
Screenings	0.60@0.65
Staunton	
3-in. lump	$1.40
Standard	
6-in. lump	$1.25@1.35
2-in. lump	1.05@1.15
Screenings	0.50@0.55
Mine-run	0.95@1.00

Anthracite is moving in small volume, chiefly on the larger sizes. Coke is getting more plentiful, but prices are still firm as last quoted.

Minneapolis—St. Paul

While the mercury has dropped to zero on a couple of occasions yet the temperature in the Northwest has been moderately balmy as a whole. This tardiness has had a bad effect on prices in this territory, and while circulars have not changed, quotations on nearly all grades of bituminous coal are unsteady. All that is needed to remedy this failing is a long continued cold spell, with a storm or two, which would make all available fuel sell at a good price.

The active season of navigation has closed on the Lakes and it is reported that

hard-coal stocks are heavier at the docks than at any previous time. Considerable was brought up during the last two weeks of navigation and dock men say their orders have been reduced to within a third of what they were 30 days ago. However, it is generally believed that the middle of January will find the docks entirely destitute of anthracite. A few cargoes were received after official navigation had closed, the boat owners charging double, and some more, than the usual carrying rates.

Ogden, Utah

In general the weather conditions over the Inter-Mountain territory remain unchanged. Ogden and Salt Lake appear to be the only localities that are experiencing cold weather. Dealers throughout the entire territory are well stocked and it will take two weeks of cold weather to create a brisk demand for coal.

Nut coal is still a drag on the market and several of the larger operators have sent their salesmen out to stimulate the demand for this grade. There has been a general slump in the demand for slack coal and at present there is quite a surplus of the steam grades. The sugar factories are approaching the end of their season and shipments have either been stopped completely or reduced to a minimum amount.

In order to meet competition with Eastern coals in Nebraska, quotations on lump dropped from $2.75 to $2.65, f.o.b. mines, in the territory east of Grand Island.

Quotations in general remain unchanged.

	Wyoming	Utah
Lump	$2.75	$2.75
Nut	2.25	2.25
Mine-run	1.85	1.85
Slack	1.00	1.25

Portland, Ore.

There is no change in the coal situation here during the week and dealers continue to report a fair volume of business. Oregon has felt very little cold weather yet and hence the demand from the eastern part of the state has been light. In western Oregon the cold weather usually occurs in January, February and March, and during these months come the heaviest demand for fuel for domestic purposes, except in seasons when the consumers have stored up well for the entire winter.

Production and Transportation Statistics

The Car Situation

In the nine days ended Nov. 30 the net shortage of coal cars decreased from 12,005 to 5179, while the net shortage of box cars decreased from 38,465 to 33,241. Flat-car shortage decreased correspondingly.

A general decrease in the surplus of coal cars prevailed except in the Virginias and Carolinas and the extreme Southwest. Against the general trend in this country figures indicate that Canadian lines were harder pressed to supply equipment on Nov. 30 than on Nov. 21.

Following is a table showing the surpluses and shortages at various recent dates:

	Surplus	Shortage	Net surplus
Nov. 30	26,135	62,536	*36,401
Nov. 21	22,363	73,475	*51,112
Nov. 7	19,987	71,156	*51,169
Oct. 24	17,289	67,270	*49,981
Oct. 10	22,810	54,389	*31,579

*Net shortage.

A year ago at this time there was a net surplus of cars totaling 36,143, which was an increase of approximately 13,000 over the previous fortnight's report.

Connellsville Coke

The *Courier* reports production in the Connellsville region as follows:

Production	Week Ending Nov. 30	Dec. 7	Dec. 14
Connellsville	218,546	214,990	212,890
Lower Connellsville	181,564	178,016	176,174
Total	400,111	393,006	389,064
Shipments To	Cars	Cars	Cars
Pittsburgh	2,863	3,410	3,985
West of Pittsburgh	8,003	7,197	6,552
East of Region	998	1,019	1,015
Total	11,864	11,626	11,552

Virginian Railway

Total shipments of coal over this road for October of the current year were 338,518 net tons, as compared with 276,851 for the month previous.

Southwestern Tonnage

The Southwestern Interstate Coal Operators Association has issued the following comparative statement of tonnage for July this year and last year:

State	1911	1912	Increase	Decrease
Missouri	173,809	176,125	2,316	
Kansas	374,137	337,367		36,770
Arkansas	120,790	126,224	5,434	
Oklahoma	157,633	201,959	44,326	
Totals	826,369	841,675	52,076	36,770

Statement only covers the tonnage of members of the Association which is estimated to be at least 95% of the entire tonnage produced in the four states

Foreign Markets

Great Britain

Dec. 5—The demand for steam coals—both large and small qualities—is great; but as colliery owners have very full order books over the remainder of this year, new business is difficult of arrangement, and sellers are having matters all their own way. Buyers are also paying a good deal of attention to shipments during the first quarter of 1913, for which position—and in fact for the whole of the year—sellers are holding for considerably higher figures than those for current business. Quotations are approximately as follows:

Best Welsh steams	$4.32@4.38
Best seconds	4.14@4.26
Seconds	4.14@4.20
Best dry coals	4.20@4.32
Best Monmouthshires	3.96@4.02
Seconds	3.84@3.90
Best Cardiff smalls	3.24@3.36
Seconds	3.06@3.18

The prices for Cardiff coals are f.o.b. Cardiff, Penarth, or Barry, while those for Monmouthshire descriptions are f.o.b. Newport; both exclusive of wharfage, and for cash in thirty days, less 2½%.

Financial Notes

The following table gives the range of various active coal securities and dividends paid during the week ending Dec. 14:

Stocks

Company	High	Low	Last
American Coal Products	90	90	90
American Coal Prod. Pref.	111	111	111
Col. Fuel & Iron	34	29¾	34
Consolidation Coal of Md.	103¾	103¼	103¼
Island Creek Coal Pref.	87⅞	87⅞	87⅞
Lehigh Valley Coal Sales	235	240	240
Pittsburg Coal	21⅜	20	20
Pittsburg Coal Pref.	88¼	83½	86¼
Pond Creek	26	23½	25
Reading	171¼	161⅝	163¼
Reading 1st. Pref.	90	90	90
Reading 2nd. Pref.	95	95	95
Virginia Iron C. & C.	58	55	55

Bonds

Company	Closing Bid	Asked	Weeks' Range or Last Sale	
Colo. F. & I. gen. s f g 5s	97	102	97	Dec. '12
Colo. F. & I. gen. 6s	107½	....	107½	June '12
Col. Ind. 1st & coll. 5s. gu.	82⅝	Sale	80⅝	83½
Cons. Ind. Coal Me. 1st 5s.	....	84½	85	June '11
Cons. Coal 1st and ref. 5s.	....	94	93	Oct. '12
Gr. Riv. Coal & C. 1st g 6s.	....	....	102⅝	Apr. '06
K. & H. C. & Co. 1st s f g 5s.	....	98	98	Dec. '12
Pocah. Con. Coll. 1st. s f 5s.	87	88	87½	88
St. L. Rky. Mt. & Pac. 1st 5s.	78½	79½	79½	79½
Tenn. Coal gen. 5s	101½	102	101½	Nov. '12
Birm. Div. 1st consol. 6s.	102½	103¾	102½	Nov. '12
Tenn. Div. 1st g 6s	101½	103	102½	Oct. '12
Cah. C. M. Co. 1st g 6s.	103½	110	110	Jan. '09
Utah Fuel 1st g 5s	....	....	....	....
Victor Fuel 1st s f 5s	....	83	85½	Oct. '12
Va. I. Coal & Coke 1st g 5s.	96	97	96	96

Island Creek Coal Co. (Common)—Regular quarterly of 50c., payable Feb. 1, to holders of record Jan. 25.

Island Creek Coal Co. (Preferred)—Regular quarterly of $1.50, payable Jan. 1, to holders of record Dec. 21.

Nova Scotia Steel & Coal Co. (Common)—Regular quarterly of 1½%, payable Jan. 15, to holders of record Dec. 31.

Nova Scotia Steel & Coal Co. (Preferred)—Regular quarterly of 2%, payable Jan. 15, to holders of record Dec. 31.

New River Coal Co.—This company appears to be getting on its feet again. In August it turned a loss of $23,000 in the preceding month into a net of $5000 after taking account of the depreciation, bond interest and interest on the $600,000 notes recently issued for working capital. This gain of $28,000 is believed to be the forerunner of better things for the New River company.

Newton Coal Co.—A number of brokers are offering a total of $1,750,000, 7% cumulative preferred stock (full voting power) redeemable at the option of the company in all or in part at 115 and accrued dividends. Real estate improvements and equipments of the concern have been independently appraised at $1,520,794; quick assets, $734,000; total assets, $2,254,794; deduct real estate mortgages, $254,000; net assets, $2,794,000.

Lehigh & Wilkes-Barre Coal Co.—The 5 per cent. bonds of this company, dated 1888, of which $2,691,000 were outstanding, matured on Nov. 1 and were paid in cash. These bonds were secured by a lease of certain lands in Luzerne County and a sinking fund of 10c. per ton was established to protect them. The retirement of this issue leaves the company with only one other outstanding issue, that of the consolidated mortgage fours dated 1910 and maturing serially from June 1, 1915, to 1950. There are $16,996,000 of these bonds outstanding.

Throwing The Searchlight On Advertising

Little Talks on a Big Subject for Coal Age Readers

By the Ad Editor

A HAPPY, HAPPY CHRISTMAS TO YOU ALL! We wish for you and those dear to you all the joy and good luck that you wish for each other.

Let us forget for the moment the time honored and oft abused system of giving presents and think only of the spirit of friendliness and good cheer which the season typifies in the minds of so many million people.

We like to think of you as something more in your relation to us than buyers of what we have to sell—more than absorbers of the information contained in our editorial and advertising columns.

Ours is a Mutual Aid Society of the very highest type and the expressions of cordiality and good will which come to us in the daily mail encourage us to give you the best that's within our power—all the time.

The good fellowship that comes from contact one with the other, the exchange of ideas, the putting of one's self in the other fellow's place, all work for the brotherhood of man which the Christmas season typifies.

Let us all have as happy a time during this holiday season as we possibly can and may the feeling of mutual helpfulness, and good fellowship continue with us during the weeks and months to come.